

Fig. 1

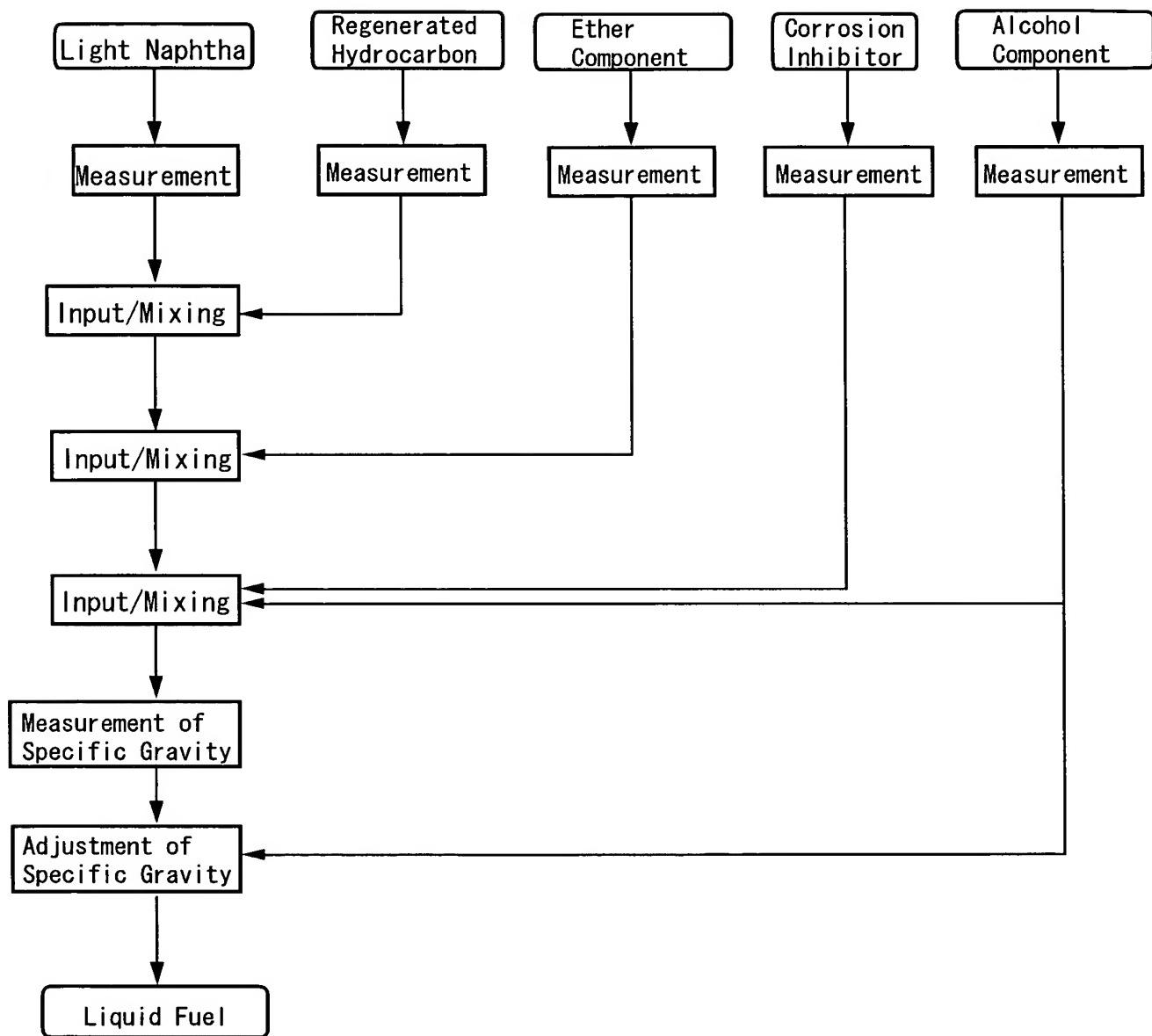
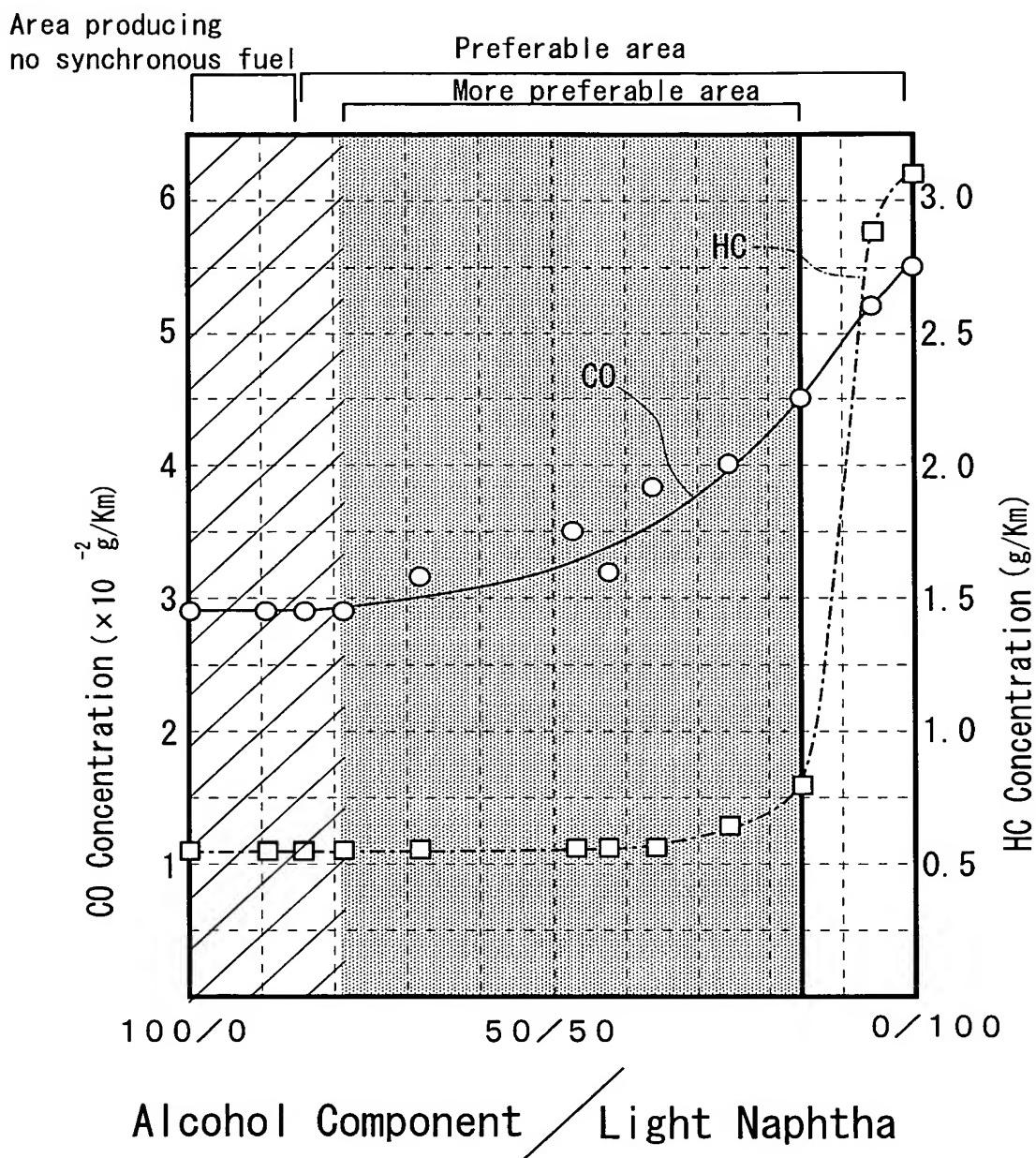


Fig. 2



Mixing Ratio (Alcohol/Ether/Naphtha)	100/0/0	85/5/10	80/5/15	75/5/20	65/5/30	40/5/55	45/5/50	35/5/60	25/5/70	15/5/80	5/5/90	0/0/100
Ratio (Alcohol/Naphtha)	100/0	89.5/10.5	84.2/15.8	78.9/21.1	68.4/31.6	42.1/57.9	47.4/52.6	36.8/63.2	26.3/73.7	15.8/84.2	5.3/94.7	0/100
HC Concentration (g/Km)	1.120	1.121	1.121	1.122	1.126	1.129	1.129	1.143	1.253	1.578	2.889	3.054
CO Concentration (g/Km)	0.029	0.029	0.029	0.029	0.032	0.032	0.035	0.038	0.040	0.045	0.051	0.055

Fig. 3

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<Ether Nonloaded Type>

Designation of Formulation	Fuel Composition					
	Naphtha	Ether	Alcohol			
			Ethanol	I P A	n B A	I B A
E 2	98		2			
E 1 0	90		10			
E 2 0	80		20			
E 5 0	50		50			
I N 4 0	60			20	20	
I N 1 5	85			10	5	
I N 7 5	25			35	40	
E I B 4 0	60		20			20
E I B 1 5	85		5			10
E I B 7 5	25		35			40
P N B 3 0	70			10	10	10
P N B 1 5	85			5	5	5
P N B 7 5	25			25	25	25
E I P P 3 0	70		10	10		
E I P P 1 5	85		5	5		
E I P P 7 5	25		25	25		
						10
						5
						25

<Ether Loaded Type>

Designation of Formulation	Fuel Composition					
	Naphtha	Ether	Alcohol			
			Ethanol	I P A	n B A	I B A
E 1 0 - E	85	5	10			
E 2 0 - E	70	10	20			
E 5 0 - E	20	30	50			
I N 4 0 - E	30	30		20	20	
I N 1 5 - E	80	5		10	5	
I N 7 5 - E	20	5		35	40	
E I B 4 0 - E	30	30	20			20
E I B 1 5 - E	80	5	5			10
E I B 7 5 - E	20	5	35			40
P N B 3 0 - E	40	30		10	10	10
P N B 1 5 - E	80	5		5	5	5
P N B 7 5 - E	20	5		25	25	25
E I P P 3 0 - E	40	30	10	10		
E I P P 1 5 - E	80	5	5	5		
E I P P 7 5 - E	20	5	25	25		
						10
						5
						25

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Fig. 4

Designation of Formulation	Fuel Composition (wt%)					Additive Kind	Loading/Fuel (wt%)	Water	Aluminum Corrosion Test			Stability of Fuel*
	H C Naphtha	Ethanol	N PA	I PA	N BA	I BA			Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	
E 10	90.0	10.0					None	0.0	100	120	5	100
	89.9	10.0					None	0.1	100	120	0	100
	90.0	10.0					None	0.0	120	24	100	100
	89.6	10.0					None	0.4	120	24	0	0
E 10-Me	89.6	10.0					None	0.5	120	24	0	0
	89.6	10.0					None	0.5	100	24	0	100
	89.6	10.0					Methanol	0.4	0.0	120	24	0
	89.6	10.0						0.5	0.0	24	0	100
E 10-PC	89.6	10.0					Propylene glycol	0.4	0.0	100	24	0
	89.6	10.0						0.5	0.0	120	24	0
	89.6	10.0					Diethyl ketone	3.5	0.0	100	24	0
	88.6	9.8						1.5	0.1	100	24	0
E 10-DEK	86.9	9.7							4.5	0.0	120	24
	86.0	9.6							2.0	0.1	120	24
	88.1	9.8							0.3	0.2	120	24
	89.6	10.0							5.0	0.4	120	24
E 10-GE	85.1	9.5							6.0	0.5	120	24
	84.2	9.4								0.5	120	24
	87.3	9.7					Ethyl formate	3.0	0.0	100	24	0
	88.1	9.8						2.0	0.1	100	24	0
E 10-PA	86.4	9.6							4.0	0.0	120	24
	87.2	9.7							3.0	0.1	120	24
	88.9	9.9							1.0	0.2	120	24
	84.2	9.4							6.0	0.4	120	24
E 10-PA	83.3	9.3							7.0	0.5	120	24
	88.7	9.9					Propionaldehyde	1.5	0.0	100	24	0
	89.0	9.9						1.0	0.1	100	24	0
	88.2	9.8							2.0	0.0	120	24
	89.0	9.9							1.0	0.1	120	24
	89.4	9.9							0.5	0.2	120	24
	86.0	9.6							4.0	0.4	120	24
	85.1	9.5							5.0	0.5	120	24

*1 100 →Perfectly phase-solved. 0 →Layer-separated

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Fig. 5

Designation of Formulation	Fuel Composition (wt%)					Additive Kind	Loading/Fuel (wt%)	Water	Aluminum Corrosion Test			Stability of Fuel*
	HC Naphtha	Ethanol	NPA	IPA	NBA	I BA			Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	
E 20	80.0	20.0					None	0.0	100	120	7	100
	79.9	20.0					None	0.1	100	120	0	100
	80.0	20.0					None	0.0	120	24	100	100
	79.3	19.8					None	0.9	120	24	0	0
E 20-Me	79.1	19.8					None	1.1	120	24	0	0
	79.6	19.9					Methanol	0.5	0.0	100	24	0
	79.6	19.9						0.5	0.0	120	24	0
	79.6	19.9						0.5	0.0	120	24	0
E 20-EG	79.6	19.9					Ethylene glycol	0.5	0.0	100	24	0
	79.6	19.9						0.5	0.0	120	24	0
	79.6	19.9						0.5	0.0	120	24	0
	77.6	19.4						0.5	0.0	120	24	0
E 20-Ac	78.7	19.7					Acetone	3.0	0.0	100	24	0
	76.8	19.2						1.5	0.1	100	24	0
	78.3	19.6						4.0	0.0	120	24	0
	79.6	19.9						2.0	0.1	120	24	0
	75.3	18.8						0.3	0.2	120	24	0
	73.5	18.4						5.0	0.9	120	24	0
	75.2	18.8						7.0	1.1	120	24	0
	77.5	19.4								100	0	
E 20-GM	73.6	18.4					Methyl formate	6.0	0.0	100	24	0
	76.7	19.2						3.0	0.1	100	24	0
	78.2	19.6						8.0	0.0	120	24	0
	74.5	18.6						4.0	0.1	120	24	0
	72.7	18.2						2.0	0.2	120	24	0
	78.4	19.6						6.0	0.9	120	24	0
	79.1	19.8						8.0	1.1	120	24	0
	78.0	19.5								100	0	
E 20-BA	79.1	19.8					Butyraldehyde	2.0	0.0	100	24	0
	79.4	19.9						1.0	0.1	100	24	0
	76.9	19.2						2.5	0.0	120	24	0
	75.9	19.0						1.0	0.1	120	24	0
								0.5	0.2	120	24	0
								3.0	0.9	120	24	0
								4.0	1.1	120	24	0

*1 100 → Perfectly phase-solved. 0 → Layer-separated

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Fig. 6

Designation of Formulation	Fuel Composition (wt%)					Additive Kind	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*†
	HC Naphtha	Alcohol	Ethanol	NPA	I PA	NBA	I BA					
E 50	50.0	50.0					None	0.0	100	120	0	100
	49.9	50.0					None	0.1	100	120	0	100
	50.0	50.0					None	0.0	120	24	100	100
	48.3	48.3					None	3.4	120	24	0	0
E 50-Me	48.2	48.2					None	3.6	120	24	0	0
	49.6	49.6					Methanol	0.8	0.0	100	24	0
	49.5	49.5						1.0	0.0	120	24	0
	49.5	49.7					Ethylene glycol	0.7	0.0	100	24	0
E 50-EG	49.5	49.5						1.0	0.0	120	24	0
	48.0	48.0					Methyl ethyl ketone	4.0	0.0	100	24	0
	49.0	49.0						2.0	0.1	100	24	0
	47.0	47.0						6.0	0.0	120	24	0
E 50-MEK	49.0	49.0						2.0	0.1	120	24	0
	49.7	49.7						0.4	0.2	120	24	0
	45.8	45.8						5.0	3.4	120	24	0
	44.7	44.7						7.0	3.6	120	24	0
E 50-GE	47.0	47.0					Ethy formate	6.0	0.0	100	24	0
	48.5	48.5						3.0	0.1	100	24	0
	45.0	45.0						10.0	0.0	120	24	0
	47.5	47.5						5.0	0.1	120	24	0
E 50-AA	48.9	48.9						2.0	0.2	120	24	0
	46.3	46.3						4.0	3.4	120	24	0
	45.2	45.2						6.0	3.6	120	24	0
	48.5	48.5					Acetaldehyde	3.0	0.0	100	24	0
	49.2	49.2						1.5	0.1	100	24	0
	48.0	48.0						4.0	0.0	120	24	0
	49.0	49.0						2.0	0.1	120	24	0
	49.4	49.4						1.0	0.2	120	24	0
	47.3	47.3						2.0	3.4	120	24	0
	46.7	46.7						3.0	3.6	120	24	0
										100	100	0

*100 —Perfectly phase-solved. 0 —Layer-separated

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Fig. 7

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Loading/Fuel (wt%)	Water	Evaluation Temp. (°C)	Evaluation Time (hr)	Aluminum Corrosion Test		Stability of Fuel*1	
	H C Naphtha	Ethanol	NPA	T PA	NBA	I BA						None	0.0	90	24
I N40	60.0	59.9		20.0	20.0		None	0.1	0.0	0.0	24	0	100	100	100
	60.0	59.9		20.0	20.0		None	0.0	0.0	120	24	100	100	100	100
	57.8	57.7		19.3	19.3		None	3.6	120	24	0	100	0	100	0
	57.7			19.2	19.2		None	3.8	120	24	0	0	0	0	0
I N40-Me	59.5	59.6		19.8	19.8		None	0.8	0.0	100	24	0	100	100	100
	59.6			19.9	19.9		None	0.4	0.2	100	24	0	100	100	100
	59.0	59.3		19.7	19.7		None	1.7	0.0	120	24	0	100	100	100
	59.3	59.5		19.8	19.8		None	1.0	0.2	120	24	0	100	100	100
	59.5	57.2		19.8	19.8		None	0.5	0.4	120	24	0	100	100	100
	57.2	56.5		19.1	19.1		None	1.0	3.6	120	24	0	100	100	100
	56.5			18.8	18.8		None	2.0	3.8	120	24	0	100	0	0
I N40-EG	59.1	59.3		19.7	19.7		Ethylene glycol	1.5	0.0	100	24	0	100	100	100
	58.2	58.7		19.4	19.4			1.0	0.2	100	24	0	100	100	100
	58.7	59.2		19.6	19.6			3.0	0.0	120	24	0	100	100	100
	59.2			19.7	19.7			2.0	0.2	120	24	0	100	100	100
	1.0							1.0	0.4	120	24	0	100	0	0
I N40-Ac	59.9	59.9		20.0	20.0		Acetone	0.2	0.0	100	24	0	100	100	100
	59.9			20.0	20.0			0.1	0.1	100	24	0	100	100	100
	59.9	59.9		20.0	20.0			0.2	0.0	120	24	0	100	100	100
	59.9	56.6		18.9	18.9			0.1	0.1	120	24	0	100	100	100
	56.6	55.9		18.6	18.6			2.0	3.6	120	24	0	100	100	0
	55.9							3.0	3.8	120	24	0	100	0	0
I N40-GM	59.1	59.5		19.7	19.7		Methyl formate	1.5	0.0	100	24	0	100	100	100
	58.2	59.3		19.4	19.4			0.8	0.1	100	24	0	100	100	100
	59.3	59.5		19.8	19.8			3.0	0.0	120	24	0	100	100	100
	59.5	56.6		19.8	19.8			1.0	0.2	120	24	0	100	100	100
	56.6	55.9		18.9	18.9			0.5	0.3	120	24	0	100	100	0
	55.9			18.6	18.6			2.0	3.6	120	24	0	100	100	0
	1.0							3.0	3.8	120	24	0	100	0	0
I N40-BA	59.8	59.8		19.9	19.9		Butyraldehyde	0.3	0.0	100	24	0	100	100	100
	59.7	59.8		19.9	19.9			0.2	0.1	100	24	0	100	100	100
	59.8			19.9	19.9			0.5	0.0	120	24	0	100	100	100
	1.0							0.2	0.1	120	24	0	100	100	0

*1 100 → Perfectly phase-separated, 0 → Layer-separated

Fig. 8

Designation of Formulation	Fuel Composition (wt%)						Additive	Water Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25°C	Low Temp. -10°C	Stability of Fuel*
	H/C Naphtha	Ethanol	NPA	IPA	NBA	I BA	Kind							
I N15	85.0 84.9		10.0 10.0	5.0 5.0			None None None		0.0 0.1	90 90	24 24	0 0	100 100	100 100
	85.0 84.5 84.3		10.0 9.9 9.9	5.0 5.0 5.0			None None None		0.0 0.6 0.8	120 120 120	24 24 24	100 0 0	100 0 0	100 0 0
	84.6 84.6		10.0 10.0	5.0 5.0			Methanol	0.5 0.3	0.0 0.2	100 100	24 24	0 0	100 100	100 100
	83.7 84.2 84.3 84.1 83.5		9.9 9.9 9.9 9.9 9.8	4.9 5.0 5.0 4.9 4.9				1.5 0.8 0.5 0.5 1.0	0.0 0.2 0.3 0.6 0.8	120 120 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 100	100 100 100 100 0
I N15-Me	84.6 84.6		10.0 10.0	5.0 5.0			Propylene glycol	2.0 1.0	0.0 0.2	100 100	24 24	0 0	100 100	100 100
	83.7 84.2 84.3 84.1 83.5		9.6 9.8 9.9 9.9	4.8 4.9 4.9 4.9				4.0 2.0 1.0	0.0 0.2 0.4	120 120 120	24 24 24	0 0 0	100 100 100 100 100	100 100 100 100 100
	83.3 84.0		9.8 9.9	4.9 4.9			Methyl isobutyl ketone	0.3 0.2	0.0 0.1	100 100	24 24	0 0	100 100	100 100
	81.6 83.1 83.8		9.6 9.8 9.9	4.8 4.9 4.9				0.5 0.2 0.1	0.0 0.2 0.1	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
I N15-PG	84.7 84.7		10.0 10.0	5.0 5.0			Ethyl formate	1.0 0.6	0.0 0.1	100 100	24 24	0 0	100 100	100 100
	84.6 84.7		10.0 10.0	5.0 5.0				0.5 0.2 0.1	0.0 0.2 0.1	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	84.1 83.5		9.9 9.8	4.9 4.9				0.5 1.0	0.6 0.8	120 120	24 24	0 0	100 100	100 0
	84.2 84.4		9.9 9.9	5.0 5.0				0.6 0.6	0.0 0.1	100 100	24 24	0 0	100 100	100 100
I N15-MBK	84.7 84.7		10.0 10.0	5.0 5.0				5.0 2.0 1.0	0.0 0.2 0.4	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	84.6 84.7		10.0 10.0	5.0 5.0				0.6 0.8	0.6 0.8	120 120	24 24	0 0	100 100	100 100
	84.1 83.5		9.9 9.8	4.9 4.9				4.0 5.0	0.6 0.8	120 120	24 24	0 0	100 100	100 0
	84.2 84.4		9.9 9.9	5.0 5.0				5.0 5.0	0.6 0.8	120 120	24 24	0 0	100 100	100 0
I N15-GE	84.8 84.8		10.0 10.0	5.0 5.0			Propionaldehyde	0.2 0.1	0.0 0.1	100 100	24 24	0 0	100 100	100 100
	80.8 83.1 83.8		9.5 9.8 9.9	4.8 4.9 4.9				5.0 2.0 1.0	0.0 0.2 0.4	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	81.1 80.1		9.5 9.4	4.8 4.7				4.0 5.0	0.6 0.8	120 120	24 24	0 0	100 100	100 0
	84.8 84.8		10.0 10.0	5.0 5.0				0.6 0.8	0.1 0.2	120 120	24 24	0 0	100 100	100 100
I N15-PA	84.8 84.8		10.0 10.0	5.0 5.0				0.2 0.1	0.0 0.1	100 100	24 24	0 0	100 100	100 100
	84.7 84.7		10.0 10.0	5.0 5.0				0.4 0.2 0.1	0.0 0.1 0.2	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	84.7 84.7		10.0 10.0	5.0 5.0				0.2 0.1	0.0 0.2	120 120	24 24	0 0	100 100	100 100
	84.7 84.7		10.0 10.0	5.0 5.0				0.2 0.1	0.0 0.1	120 120	24 24	0 0	100 100	100 100

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 9

Designation of Formulation	Fuel Composition (wt%)				Additive Kind	Loading/Fuel (wt%)	Water	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	Stability of Fuel*
	H/C Naphtha	Ethanol	NPA	Alcohol									
I N75	25.0	35.0	40.0	None	None	0.0	90	24	100	100	100	100	100
	25.0	35.0	40.0	None	None	0.1	90	24	100	100	100	100	100
	25.0	34.9	39.9	None	None	0.2	90	24	0	100	100	100	100
	25.0	35.0	40.0	None	None	0.0	120	24	100	100	100	100	100
	24.9	34.8	39.8	None	None	0.6	120	24	100	100	100	100	100
	24.8	34.7	39.7	None	None	0.8	120	24	0	100	100	100	100
I N75-Me	24.8	34.7	39.6	Methanol	1.0	0.0	100	24	0	100	100	100	100
	24.8	34.7	39.7		0.5	0.3	100	24	0	100	100	100	100
	24.5	34.3	39.2		2.0	0.0	120	24	0	100	100	100	100
	24.7	34.5	39.5		1.0	0.3	120	24	0	100	100	100	100
	24.8	34.7	39.6		0.5	0.5	120	24	0	100	100	100	100
I N75-E G	24.3	34.0	38.8	Ethyleneglycol	3.0	0.0	100	24	0	100	100	100	100
	24.4	34.2	39.1		2.0	0.3	100	24	0	100	100	100	100
	23.5	32.9	37.6		6.0	0.0	120	24	0	100	100	100	100
	23.9	33.5	38.3		4.0	0.3	120	24	0	100	100	100	100
	24.4	34.1	39.0		2.0	0.5	120	24	0	100	100	100	100
I N75-MPK	25.0	34.9	39.9	Methyl-tri- propyl ketone	0.2	0.0	100	24	0	100	100	100	100
	25.0	34.9	39.9		0.1	0.1	100	24	0	100	100	100	100
	25.0	34.9	39.9		0.2	0.0	120	24	0	100	100	100	100
	25.0	34.9	39.9		0.1	0.1	120	24	0	100	100	100	100
I N75-GE	24.5	34.3	39.2	Methyl formate	2.0	0.0	100	24	0	100	100	100	100
	24.7	34.6	39.6		1.0	0.1	100	24	0	100	100	100	100
	24.1	33.8	38.6		3.5	0.0	120	24	0	100	100	100	100
	24.6	34.4	39.3		1.5	0.2	120	24	0	100	100	100	100
	24.7	34.6	39.6		0.8	0.3	120	24	0	100	100	100	100
I N75-AA	24.9	34.9	39.9	Acetaldehyde	0.3	0.0	100	24	0	100	100	100	100
	24.9	34.9	39.9		0.2	0.1	100	24	0	100	100	100	100
	24.9	34.8	39.8		0.6	0.0	120	24	0	100	100	100	100
	24.9	34.9	39.8		0.3	0.1	120	24	0	100	100	100	100
	24.9	34.9	39.8		0.2	0.2	120	24	0	100	100	100	100

*1 100 → Perfectly phase-solved. 0 → Layer-separated

10/53908

Fig. 10

Designation of Formulation	Fuel Composition (wt%)						Additive	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*
	H C Naphtha	Ethanol	N PA	I PA	N BA	I BA			Room Temp. 25° C	Evaluation Temp. (°C)	Weight Loss (%)	
E I B 40	60.0	20.0			20.0		None	0.0	90	24	0	100
	59.9	20.0			20.0		None	0.1	90	24	0	100
	60.0	20.0			19.0		None	0.0	120	24	100	100
E I B 40-Me	57.1	19.0			19.0		None	4.8	120	24	0	0
	56.9	19.0			19.0		None	5.1	120	24	0	0
	59.1	19.7			19.7		Methanol	1.5	0.0	24	0	100
E I B 40-E G	59.1	19.7			19.7			0.8	100	24	0	100
	58.8	19.6			19.6			0.5	100	24	0	100
	58.9	19.6			19.7			2.0	0.0	24	0	100
E I B 40-Ac	59.1	19.7			19.7			1.0	120	24	0	100
	59.4	20.0			20.0		Acetone	0.2	0.0	24	0	100
	59.9	20.0			20.0			0.1	100	24	0	100
E I B 40-GM	58.2	19.4			19.4			3.0	0.0	120	24	0
	59.3	19.8			19.8			1.0	0.2	120	24	0
	59.6	19.9			19.9			0.2	0.5	120	24	0
E I B 40-BA	55.3	18.4			18.4			3.0	4.8	120	24	0
	54.5	18.2			18.2			4.0	5.1	120	24	0
	58.5	19.5			19.5		Methyl formate	2.5	0.0	100	24	0
	59.0	19.7			19.7			1.5	0.2	100	24	0
	57.0	19.0			19.0			5.0	0.0	120	24	0
	58.7	19.6			19.6			2.0	0.2	120	24	0
	59.1	19.7			19.7			1.0	0.5	120	24	0
	55.9	18.6			18.6			2.0	4.8	120	24	0
	55.1	18.4			18.4			3.0	5.1	120	24	0
	59.6	19.9			19.9		Butylaldehyde	0.6	0.0	100	24	0
	59.6	19.9			19.9			0.1	0.5	100	24	0
	59.4	19.8			19.8			1.0	0.0	120	24	0
	59.6	19.9			19.9			0.2	0.5	120	24	0
	59.3	19.8			19.8			0.1	1.0	120	24	0
	56.5	18.8			18.8			1.0	4.8	120	24	0
	55.7	18.6			18.6			2.0	5.1	120	24	0

*1 100 → Perfectly phase-solved. 0 → layer-separated

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Fig. 11

Designation of Formulation	Fuel Composition (wt%)					Additive Kind	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*1 25°C
	H C Naphtha	Ethanol	NPA	IPA	NBA	I BA			Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	
EIB15	85.0 84.9	5.0 5.0			10.0 10.0	None None		0.0 0.1	90 90	24 24	0 0	100 100
	85.0 84.5 84.3	5.0 5.0 5.0			10.0 9.9 9.9	None None None		0.0 0.6 0.8	120 120 120	24 24 24	100 0 0	100 0 0
	84.2 84.3	5.0 5.0			9.9 9.9	Methanol	1.0 0.5	0.0 0.3	100 100	24 24	0 0	100 100
	83.7 84.0 84.0 83.0	4.9 4.9 4.9 4.9			9.9 9.9 9.9 9.8		1.5 0.8 0.6 1.5	0.0 0.4 0.6 0.8	120 120 120 120	24 24 24 24	0 0 0 0	100 100 100 0
EIB15-Me	84.2 84.3	5.0 5.0			9.9 9.9							
	83.7 84.0 84.0 83.0	4.9 4.9 4.9 4.9			9.9 9.9 9.9 9.8							
	83.7 84.2	4.9 5.0			9.9 9.9	Propylene glycol	1.5 0.8	0.0 0.2	100 100	24 24	0 0	100 100
	82.5 83.0 83.7	4.9 4.9 4.9			9.7 9.8 9.9		3.0 2.0 1.0	0.0 0.3 0.5	120 120 120	24 24 24	0 0 0	100 100 100
EIB15-P G	83.7 84.2	4.9 5.0			9.9 9.9	Diethyl Ketone	1.0 0.4	0.0 0.1	100 100	24 24	0 0	100 100
	82.5 83.0 83.7	4.9 4.9 4.9			9.7 9.8 9.9		1.5 0.7 0.2	0.0 0.1 0.3	120 120 120	24 24 24	0 0 0	100 100 100
	84.2 84.6	5.0 5.0			9.9 10.0	Diethyl Ketone	1.0 0.4	0.0 0.1	100 100	24 24	0 0	100 100
	83.7 84.3 84.6 82.4 81.3	4.9 5.0 5.0 4.8 4.8			9.9 9.9 10.0 9.7 9.6		1.5 0.7 0.2 2.5 3.5	0.0 0.1 0.3 0.6 0.8	120 120 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 0
EIB15-DEX	84.2 84.6	5.0 5.0			9.9 10.0	Methyl acetate	2.0 1.0	0.0 0.3	100 100	24 24	0 0	100 100
	83.7 84.3 84.6 82.4 81.3	4.9 5.0 5.0 4.8 4.8			9.9 9.9 10.0 9.7 9.6		1.5 0.7 0.2 2.5 3.5	0.0 0.1 0.3 0.6 0.8	120 120 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 0
	83.3 83.9	4.9 4.9			9.8 9.9							
	82.5 83.6 84.0 81.9 80.9	4.9 4.9 4.9 4.8 4.8			9.7 9.8 9.9 9.6 9.5							
EIB15-SM	83.3 83.9	4.9 4.9			9.8 9.9	Propionaldehyde	0.6 0.1	0.0 0.3	100 100	24 24	0 0	100 100
	82.5 83.6 84.0 81.9 80.9	4.9 4.9 4.9 4.8 4.8			9.7 9.8 9.9 9.6 9.5		3.0 1.5 0.7 3.0 4.0	0.0 0.2 0.5 0.6 0.8	120 120 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 0
	84.5 84.7	5.0 5.0			9.9 10.0							
	84.2 84.5 84.5	5.0 5.0 5.0			9.9 9.9 9.9							
EIB15-PA	84.5 84.7	5.0 5.0			9.9 10.0	Propionaldehyde	0.6 0.1	0.0 0.3	100 100	24 24	0 0	100 100
	84.2 84.5 84.5	5.0 5.0 5.0			9.9 9.9 9.9							

*1 100 →Perfectly phase-solved, 0 →Layer-separated

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Fig. 12

Designation of Formulation	Fuel Composition (wt%)					Additive	Water Loading/Fuel (wt%)	Evaluation Temp. (°C)	Aluminum Corrosion Test Time (hr)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	Stability of Fuel*	
	H C Naphtha	Ethanol	NPA	IPA	NBA	I B A								
EIB75	25.0	35.0			40.0		None	0.0	90	24	100	100	100	
	25.0	34.9			40.0		None	0.1	90	24	100	100	100	
	25.0	34.9			39.9		None	0.2	90	24	0	100	100	
	25.0	35.0			40.0		None	0.0	120	24	100	100	100	
	24.8	34.7			39.6		None	1.0	120	24	100	100	100	
	24.7	34.6			39.5		None	1.2	120	24	0	100	100	
EIB75-Me	24.6	34.5			39.4		Methanol	1.5	0.0	100	24	0	100	100
	24.6	34.5			39.4			1.0	100	24	0	100	100	
	24.5	34.3			39.2			2.0	0.0	120	24	0	100	100
	24.5	34.3			39.2			1.5	0.5	120	24	0	100	100
	24.5	34.3			39.2			1.0	1.0	120	24	0	100	100
	24.3	34.0			38.8		Ethylene glycol	3.0	0.0	100	24	0	100	100
EIB75-E	24.5	34.3			39.2			1.5	0.4	100	24	0	100	100
	23.8	33.3			38.0			5.0	0.0	120	24	0	100	100
	24.2	33.8			38.7			3.0	0.3	120	24	0	100	100
	24.4	34.1			39.0			2.0	0.5	120	24	0	100	100
	24.3	34.0			38.8		Methyl ethyl ketone	3.0	0.0	100	24	0	100	100
	24.9	34.8			39.8			0.3	100	24	0	100	100	
EIB75-MEK	23.8	33.3			38.0			5.0	0.0	120	24	0	100	100
	24.5	34.2			39.1			2.0	0.2	120	24	0	100	100
	24.7	34.6			39.5			0.2	1.0	120	24	0	100	100
	24.0	33.6			38.4		Methyl formate	4.0	0.0	100	24	0	100	100
	24.4	34.2			39.1			2.0	0.3	100	24	0	100	100
	23.0	32.2			36.8			8.0	0.0	120	24	0	100	100
EIB75-GM	23.9	33.5			38.3			4.0	0.3	120	24	0	100	100
	24.4	34.1			39.0			2.0	0.5	120	24	0	100	100
	24.8	34.7			39.7		Acetaldehyde	0.8	0.0	100	24	0	100	100
	24.9	34.8			39.8			0.2	0.3	100	24	0	100	100
	24.8	34.7			39.6			1.0	0.0	120	24	0	100	100
	24.8	34.8			39.7			0.4	0.3	120	24	0	100	100
EIB75-AA	24.8	34.8			39.7			0.2	0.5	120	24	0	100	100
	24.8	34.8			39.7									
	24.8	34.8			39.7									
	24.8	34.8			39.7									
	24.8	34.8			39.7									
	24.8	34.8			39.7									

*1 100 —Perfectly phase-solved, 0 —Layer-separated

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Fig. 13

Designation of Formulation	Fuel Composition (wt%)					Additive Kind	Water Loading/Fuel (wt%)	Aluminum Loading/Fuel (wt%)	Evaluation Test			Stability of Fuel*1
	H.C Naphtha	Ethanol	NPA	I.PA	N.B.A				Temp. (°C)	Time (hr)	Weight Loss (%)	
PNB30	70.0	10.0	10.0	10.0	10.0	None	0.0	80	120	19	100	100
	69.9	10.0	10.0	10.0	10.0	None	0.1	80	120	0	100	100
	70.0	10.0	10.0	10.0	10.0	None	0.0	120	24	100	100	100
	68.7	9.8	9.8	9.8	9.8	None	1.8	120	24	0	100	0
PNB30-Me	68.6	9.8	9.8	9.8	9.8	None	2.0	120	24	0	0	0
	69.3	9.9	9.9	9.9	9.9	Methanol	1.0	0.0	100	24	0	100
	69.5	9.9	9.9	9.9	9.9		0.4	100	24	0	100	100
	69.0	9.9	9.9	9.9	9.9		1.5	0.0	120	24	0	100
PNB30-E	69.2	9.9	9.9	9.9	9.9		1.0	0.2	120	24	0	100
	68.3	9.8	9.8	9.8	9.8		2.5	0.0	120	24	0	100
	68.8	9.8	9.8	9.8	9.8		1.5	0.2	120	24	0	100
	69.1	9.9	9.9	9.9	9.9		1.0	0.3	120	24	0	100
PNB30-EG	67.2	9.6	9.6	9.6	9.6		2.0	2.0	120	24	0	100
	68.6	9.8	9.8	9.8	9.8	Ethylene glycol	2.0	0.0	100	24	0	100
	69.2	9.9	9.9	9.9	9.9		1.0	0.2	100	24	0	100
	68.3	9.8	9.8	9.8	9.8		2.5	0.0	120	24	0	100
PNB30-Ac	69.1	9.9	9.9	9.9	9.9		1.5	0.2	120	24	0	100
	69.9	10.0	10.0	10.0	10.0	Acetone	0.2	0.0	100	24	0	100
	69.9	10.0	10.0	10.0	10.0		0.1	0.1	100	24	0	100
	69.9	10.0	10.0	10.0	10.0		0.1	0.1	120	24	0	100
PNB30-AC	66.5	9.5	9.5	9.5	9.5		3.0	2.0	120	24	0	100
	67.3	9.6	9.6	9.6	9.6		2.0	1.8	120	24	0	100
	66.5	9.5	9.5	9.5	9.5		3.0	2.0	120	24	0	100
	69.9	10.0	10.0	10.0	10.0		0.1	0.1	100	24	0	100
PNB30-GM	69.0	9.9	9.9	9.9	9.9	Methyl formate	1.5	0.0	100	24	0	100
	69.2	9.9	9.9	9.9	9.9		1.0	0.2	100	24	0	100
	68.3	9.8	9.8	9.8	9.8		2.5	0.0	120	24	0	100
	68.8	9.8	9.8	9.8	9.8		1.5	0.2	120	24	0	100
PNB30-BA	69.4	9.9	9.9	9.9	9.9		0.6	0.3	120	24	0	100
	66.6	9.5	9.5	9.5	9.5		3.0	1.8	120	24	0	100
	65.5	9.4	9.4	9.4	9.4		4.5	2.0	120	24	0	100
	69.7	10.0	10.0	10.0	10.0	Acetaldehyde	0.4	0.0	100	24	0	100
PNB30-BA	69.8	10.0	10.0	10.0	10.0		0.1	0.2	100	24	0	100
	69.7	10.0	10.0	10.0	10.0		0.5	0.0	120	24	0	100
	69.7	10.0	10.0	10.0	10.0		0.2	0.3	120	24	0	100

*1 100 —Perfectly phase-solved, 0 —Layer-separated

Fig. 14

Designation of Formulation	Fuel Composition (wt%)					Additive Kind	Water Loading/Fuel (wt%)	Aluminum Corrosion Test, Evaluation Time (hr) Temp. (°C)	Weight Loss Rate (%)	Stability of Fuel at 25° C	Room Temp. Low Temp. -10° C
	HC Naphtha	Ethanol	NPA	IPA	NBA						
PNB15	85.0		5.0	5.0	5.0	None	0.0	80	120	0	100
	84.9		5.0	5.0	5.0	None	0.1	80	120	0	100
	85.0		5.0	5.0	5.0	None	0.0	120	24	100	100
	84.6		5.0	5.0	5.0	None	0.5	120	24	0	0
PNB15-Me	84.4		5.0	5.0	5.0	None	0.7	120	24	0	0
	84.3		5.0	5.0	5.0	Methanol	0.8	0.0	100	24	0
	84.5		5.0	5.0	5.0		0.4	0.2	100	24	0
	83.7		4.9	4.9	4.9		1.5	0.0	120	24	0
PNB15-PG	84.0		4.9	4.9	4.9		1.0	0.2	120	24	0
	84.3		5.0	5.0	5.0		0.5	0.3	120	24	0
	82.9		4.9	4.9	4.9		2.0	0.5	120	24	0
	81.9		4.8	4.8	4.8		3.0	0.7	120	24	0
PNB15-MPK	82.5		4.9	4.9	4.9	Propylene Glycol	3.0	0.0	100	24	0
	83.6		4.9	4.9	4.9		1.5	0.2	100	24	0
	81.6		4.8	4.8	4.8		4.0	0.0	120	24	0
	83.1		4.9	4.9	4.9		2.0	0.2	120	24	0
PNB15-SM	83.9		4.9	4.9	4.9		1.0	0.3	120	24	0
	84.7		5.0	5.0	5.0	Methyl-n-propyl ketone	0.3	0.0	100	24	0
	84.7		5.0	5.0	5.0		0.2	0.1	100	24	0
	84.6		5.0	5.0	5.0		0.5	0.0	120	24	0
PNB15-AA	84.7		4.7	4.7	4.7		0.2	0.2	120	24	0
	81.2		4.8	4.8	4.8		4.0	0.5	120	24	0
	80.2		4.7	4.7	4.7		5.0	0.7	120	24	0
	83.7		4.9	4.9	4.9	Methyl acetate	1.5	0.0	100	24	0
PNB15-AA	84.0		4.9	4.9	4.9		1.0	0.2	100	24	0
	79.9		4.7	4.7	4.7		6.0	0.0	120	24	0
	82.3		4.8	4.8	4.8		3.0	0.2	120	24	0
	83.9		4.9	4.9	4.9		1.0	0.3	120	24	0
PNB15-AA	79.5		4.7	4.7	4.7		6.0	0.5	120	24	0
	78.5		4.6	4.6	4.6		7.0	0.7	120	24	0
	84.7		5.0	5.0	5.0	Acetaldehyde	0.3	0.0	100	24	0
	84.7		5.0	5.0	5.0		0.2	0.1	100	24	0
PNB15-AA	84.6		5.0	5.0	5.0		0.5	0.0	120	24	0
	84.7		5.0	5.0	5.0		0.2	0.2	120	24	0

*1 100 →Perfectly phase-solved. 0 →Layer-separated

Fig. 15

Designation of Formulation	Fuel Composition (wt%)					Additive	Loading/Fuel (wt%)	Water (wt%)	Aluminum Corrosion Test			Stability of Fuel*
	H C Naphtha	Ethanol	NPA	IPA	I BA				Kind	Temp. (°C)	Time (hr)	
PNB75	25.0		25.0	25.0	25.0	None None None None None None	0.0 0.1 0.2 0.0 10.0 10.5	80 80 80 120 120 120	120 120 120 24 24 24	100 85 0 100 100 0	100 100 100 100 100 0	100 100 100 100 100 0
	25.0	25.0	24.9	25.0	25.0				None	120	24	
	25.0	25.0	24.9	24.9	25.0				None	120	24	
	25.0	25.0	25.0	25.0	25.0				None	120	24	
	22.5	22.5	22.5	22.5	22.5				None	120	24	
	22.4	22.4	22.4	22.4	22.4				None	120	24	
PNB75-Me	24.8		24.8	24.8	24.8	Methanol	1.0 0.4 2.0 1.5 0.8 2.0	100 100 120 120 120 120	24 24 24 24 24 24	0 0 24 24 24 24	100 100 100 100 100 100	100 100 100 100 100 0
	24.8		24.8	24.8	24.8				None	100	24	
	24.5	24.5	24.5	24.5	24.5				None	120	24	
	24.6	24.6	24.6	24.6	24.6				None	120	24	
	24.7	24.7	24.7	24.7	24.7				None	120	24	
	22.0	22.0	22.0	22.0	22.0				None	120	24	
PNB75-EG	21.6		21.6	21.6	21.6	Ethylene glycol	3.0 2.0 0.0 0.3 0.3 0.4	10.5 10.5 100 120 120 120	24 24 100 120 120 120	0 0 24 24 24 24	100 100 100 100 100 100	0 0 100 100 100 0
	24.0	24.0	24.0	24.0	24.0				None	100	24	
	24.4	24.4	24.4	24.4	24.4				None	100	24	
	23.5	23.5	23.5	23.5	23.5				None	120	24	
	24.2	24.2	24.2	24.2	24.2				None	120	24	
	24.4	24.4	24.4	24.4	24.4				None	120	24	
PNB75-MEK	24.9		24.9	24.9	24.9	Methyl ethyl ketone	0.3 0.1 0.5 0.2 0.2 0.4	100 100 120 120 120 120	24 24 24 24 24 24	0 0 24 24 24 24	100 100 100 100 100 100	100 100 100 100 100 0
	24.9	24.9	24.9	24.9	24.9				None	100	24	
	24.9	24.9	24.9	24.9	24.9				None	120	24	
	24.9	24.9	24.9	24.9	24.9				None	120	24	
	21.8	21.8	21.8	21.8	21.8				None	120	24	
	21.4	21.4	21.4	21.4	21.4				None	120	24	
PNB75-GE	24.0		24.0	24.0	24.0	Ethy formate	4.0 2.0 6.0 3.0 1.0 5.0	100 100 120 120 120 120	24 24 24 24 24 24	0 0 24 24 24 24	100 100 100 100 100 100	100 100 100 100 100 0
	24.5	24.5	24.5	24.5	24.5				None	100	24	
	23.5	23.5	23.5	23.5	23.5				None	120	24	
	24.2	24.2	24.2	24.2	24.2				None	120	24	
	24.7	24.7	24.7	24.7	24.7				None	120	24	
	21.5	21.5	21.5	21.5	21.5				None	120	24	
PNB75-PA	21.1	21.1	21.1	21.1	21.1	Propionaldehyde	0.3 0.1 0.5 0.2	100 100 120 120	24 24 24 24	0 0 24 24	100 100 100 100	100 100 100 100
	24.9	24.9	24.9	24.9	24.9				None	100	24	
	24.9	24.9	24.9	24.9	24.9				None	100	24	
	24.9	24.9	24.9	24.9	24.9				None	100	24	

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 16

Designation of Formulation	Fuel Composition (wt%)					Kind	Loading/Fuel (wt%)	Water	Aluminum Corrosion Test			Stability of Fuel*
	Naphthalene	Ethanol	NPA	I.P.A.	N.B.A.				Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	
EIPPP30	70.0	10.0	10.0	10.0	10.0	None	0.0	80	120	120	51	100 100
	69.9	10.0	10.0	10.0	10.0	None	0.1	80	120	120	0	100 100
	70.0	10.0	10.0	9.8	9.7	None	0.0	120	24	100	100	100 0
	68.3	9.8	9.8	9.7	9.7	None	2.5	120	24	0	100	100 0
EIPPP30-Me	69.0	9.9	9.9	9.9	9.9	Methanol	1.5	0.0	100	24	0	100 100
	69.4	9.9	9.9	9.9	9.9		0.5	0.4	100	24	0	100 100
	68.3	9.8	9.8	9.8	9.8		2.5	0.0	120	24	0	100 100
	68.6	9.8	9.8	9.8	9.9		1.5	0.5	120	24	0	100 100
EIPPP30-EG	69.0	9.9	9.9	9.9	9.9		0.5	1.0	120	24	0	100 100
	68.6	9.8	9.8	9.8	9.9	Ethylene glycol	2.0	0.0	100	24	0	100 100
	69.0	9.9	9.9	9.9	9.9		1.0	0.4	100	24	0	100 100
	66.5	9.5	9.5	9.6	9.6		5.0	0.0	120	24	0	100 100
EIPPP30-Ac	67.5	9.6	9.6	9.6	9.7		3.0	0.6	120	24	0	100 100
	67.9	9.7	9.7	9.7	9.7		2.0	1.0	120	24	0	100 100
EIPPP30-GM	67.9	9.7	9.7	9.7	10.0	Acetone	3.0	0.0	100	24	0	100 100
	69.7	10.0	10.0	10.0	10.0		0.2	0.3	100	24	0	100 100
	67.2	9.6	9.6	9.6	9.6		4.0	0.0	120	24	0	100 100
	69.2	9.9	9.9	9.9	9.9		1.0	0.2	120	24	0	100 100
EIPPP30-BA	64.1	9.2	9.2	9.2	9.0		0.2	0.5	120	24	0	100 100
	63.0	9.0	9.0	9.0	9.0		6.0	2.5	120	24	0	100 0
	69.0	9.9	9.9	9.9	9.9	Methyl formate	1.5	0.0	100	24	0	100 100
	69.2	9.9	9.9	9.9	9.9		1.0	0.2	100	24	0	100 100
EIPPP30-BM	65.8	9.4	9.4	9.4	9.4		6.0	0.0	120	24	0	100 100
	69.0	9.9	9.9	9.9	9.9		1.0	0.5	120	24	0	100 100
	69.2	9.9	9.9	9.9	9.9		0.2	1.0	120	24	0	100 100
	63.4	9.1	9.1	9.1	8.9		7.0	2.5	120	24	0	100 0
EIPPP30-BA	62.3	8.9	8.9	8.9	8.9		8.0	3.0	120	24	0	100 0
	69.6	9.9	9.9	9.9	10.0	Butyl aldehyde	0.6	0.0	100	24	0	100 100
	69.7	10.0	10.0	10.0	10.0		0.2	0.3	100	24	0	100 100
	69.3	9.9	9.9	9.9	9.9		1.0	0.0	120	24	0	100 100
EIPPP30-BM	69.5	9.9	9.9	9.9	9.9		0.2	0.5	120	24	0	100 100

*1 100 → Perfectly phase-solved. 0 → layer-separated

Fig. 17

Designation of Formulation	Fuel Composition (wt%)					Additive	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ethanol	NPA	IPA	NBA			Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	
EIPPI5	85.0	5.0	5.0	5.0	5.0	None	0.0	80	120	120	16	100
	84.9	5.0	5.0	5.0	5.0	None	0.1	80	120	0	100	100
	85.0	5.0	5.0	5.0	5.0	None	0.0	120	24	100	100	100
	84.3	5.0	5.0	5.0	5.0	None	0.8	120	24	0	100	0
EIPPI5-Me	84.2	5.0	5.0	5.0	5.0	Methanol	1.0	0.0	100	24	0	100
	84.2	5.0	5.0	5.0	5.0	Methanol	0.5	0.4	100	24	0	100
	83.3	4.9	4.9	4.9	4.9		2.0	0.0	120	24	0	100
	83.8	4.9	4.9	4.9	4.9		1.0	0.4	120	24	0	100
EIPPI5-PG	84.1	4.9	4.9	4.9	4.9		0.5	0.6	120	24	0	100
	82.9	4.9	4.9	4.9	4.9	Propylene glycol	2.5	0.0	100	24	0	100
	83.5	4.9	4.9	4.9	4.9		1.5	0.3	100	24	0	100
	81.6	4.8	4.8	4.8	4.8		4.0	0.0	120	24	0	100
EIPPI5-DEK	83.0	4.9	4.9	4.9	4.9		2.0	0.4	120	24	0	100
	83.3	4.9	4.9	4.9	4.9		1.5	0.5	120	24	0	100
	83.3	4.9	4.9	4.9	5.0	Diethyl ketone	2.0	0.0	100	24	0	100
	84.6	5.0	5.0	5.0	5.0		0.2	0.3	100	24	0	100
EIPPI5-SM	82.5	4.9	4.9	4.9	5.0		3.0	0.0	120	24	0	100
	84.2	5.0	5.0	5.0	5.0		0.8	0.2	120	24	0	100
	84.4	5.0	5.0	5.0	5.0		0.2	0.5	120	24	0	100
	80.9	4.8	4.8	4.8	4.8		4.0	0.8	120	24	0	100
EIPPI5-PA	79.9	4.7	4.7	4.7	4.7		5.0	1.0	120	24	0	100
	84.0	4.9	4.9	4.9	5.0	Methyl acetate	1.2	0.0	100	24	0	100
	84.2	5.0	5.0	5.0	5.0		0.7	0.2	100	24	0	100
	81.6	4.8	4.8	4.8	4.8		4.0	0.0	120	24	0	100
EIPPI5-PA	83.8	4.9	4.9	4.9	5.0		1.0	0.4	120	24	0	100
	84.2	5.0	5.0	5.0	5.0		0.2	0.8	120	24	0	100
	80.1	4.7	4.7	4.7	4.7		5.0	0.8	120	24	0	100
	79.1	4.7	4.7	4.7	4.7		6.0	1.0	120	24	0	100
EIPPI5-PA	84.6	5.0	5.0	5.0	5.0	Propionaldehyde	0.5	0.0	100	24	0	100
	84.6	5.0	5.0	5.0	5.0		0.2	0.3	100	24	0	100
	84.3	5.0	5.0	5.0	5.0		0.8	0.0	120	24	0	100
	84.5	5.0	5.0	5.0	5.0		0.2	0.4	120	24	0	100

*1 100 → Perfectly phase-separated, 0 → Layer-separated

Fig. 18

Designation of Formulation	Fuel Composition (wt%)					Additive Kind	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*1 Room Temp. 25°C	Low Temp. -10°C
	H C Naphtha	Ethanol	N PA	I PA	N BA				Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)		
EIPP75	25.0	25.0	25.0	25.0	25.0	None	0.0	0.0	80	120	100	100	100
	25.0	24.9	25.0	24.9	25.0	None	0.1	0.1	80	120	55	100	100
	25.0	24.9	24.9	24.9	25.0	None	0.2	0.2	80	120	0	100	100
	25.0	25.0	25.0	24.6	24.6	None	0.0	0.0	120	24	100	100	100
	24.6	24.6	24.6	24.6	24.6	None	1.5	1.5	120	24	100	100	100
	24.6	24.6	24.6	24.6	24.6	None	1.7	1.7	120	24	0	100	100
EIPP75-Me	24.5	24.5	24.5	24.5	24.5	Methanol	2.0	0.0	100	24	0	100	100
	24.6	24.6	24.6	24.6	24.6	Methanol	1.0	0.5	100	24	0	100	100
	24.3	24.3	24.3	24.3	24.3		3.0	0.0	120	24	0	100	100
	24.4	24.4	24.4	24.4	24.4		2.0	0.5	120	24	0	100	100
	24.6	24.6	24.6	24.6	24.6		0.6	1.0	120	24	0	100	100
	24.0	24.0	24.0	24.0	24.0	Ethylene glycol	4.0	0.0	100	24	0	100	100
EIPP75-EG	24.4	24.4	24.4	24.4	24.4	Ethylene glycol	2.0	0.5	100	24	0	100	100
	23.0	23.0	23.0	23.0	23.0		8.0	0.0	120	24	0	100	100
	23.6	23.6	23.6	23.6	23.6		5.0	0.5	120	24	0	100	100
	24.0	24.0	24.0	24.0	24.0		3.0	1.0	120	24	0	100	100
	24.3	24.3	24.3	24.3	24.3	Methyl ethyl ketone	3.0	0.0	100	24	0	100	100
	24.9	24.9	24.9	24.9	24.9	Methyl ethyl ketone	0.2	0.3	100	24	0	100	100
EIPP75-MEK	23.8	23.8	23.8	23.8	23.8		5.0	0.0	120	24	0	100	100
	24.7	24.7	24.7	24.7	24.7		1.0	0.2	120	24	0	100	100
	24.8	24.8	24.8	24.8	24.8		0.2	0.5	120	24	0	100	100
	24.3	24.3	24.3	24.3	24.3	Methyl formate	3.0	0.0	100	24	0	100	100
	24.4	24.4	24.4	24.4	24.4	Methyl formate	2.0	0.4	100	24	0	100	100
	22.8	22.8	22.8	22.8	22.8		9.0	0.0	120	24	0	100	100
EIPP75-GM	24.4	24.4	24.4	24.4	24.4		2.0	0.5	120	24	0	100	100
	24.6	24.6	24.6	24.6	24.6		0.5	1.0	120	24	0	100	100
	24.9	24.9	24.9	24.9	24.9	Acetaldehyde	0.5	0.0	100	24	0	100	100
	24.8	24.8	24.8	24.8	24.8	Acetaldehyde	0.2	0.2	100	24	0	100	100
	24.8	24.8	24.8	24.8	24.8		1.0	0.0	120	24	0	100	100
	24.8	24.8	24.8	24.8	24.8		0.2	0.5	120	24	0	100	100

*1 100 → Perfectly phase-solved. 0 → Layer-separated

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Fig. 19

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ether MTBE	Alcohol Ethanol	NPA I PA	NBA I BA	None				0.0	100	120	2	
E10-E	85.0 84.9	5.0 5.0	10.0 10.0			None None	None None	0.1	100	120	0	100	100	
	85.0 84.7 84.6	5.0 5.0 5.0	10.0 10.0 10.0			None None None	None None None	0.0 0.4 0.5	120 120 120	24 24 24	89 0 0	100 100 0	100 0 0	
E10-E-Me	84.7	5.0	10.0			Methanol	0.4	0.0	100	24	0	0	100	100
	84.6	5.0	10.0					0.5	0.0	120	24	0	100	100
E10-E-PG	84.7	5.0	10.0			Propylene glycol	0.4	0.0	100	24	0	0	100	100
	84.6	5.0	10.0					0.5	0.0	120	24	0	100	100
E10-E-DEK	82.0 83.6	4.8 4.9	9.7 9.8			Diethyl ketone	3.5 1.5	0.0 0.1	100 100	24	0	0	100	100
	81.2 83.2 84.6 80.4 79.5	4.8 4.9 5.0 4.7 4.7	9.6 9.8 10.0 9.5 9.4				4.5 2.0 0.3 5.0 6.0	0.0 0.1 0.2 0.4 0.5	120 120 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 100	100 100 100 100 0	
E10-E-GE	82.5 83.2	4.9 4.9	9.7 9.8			Ethyl formate	3.0 2.0	0.0 0.1	100 100	24	0	0	100	100
	81.6 82.4 84.0 79.6 78.6	4.8 4.8 4.9 4.7 4.6	9.6 9.7 9.9 9.4 9.3				4.0 3.0 1.0 6.0 7.0	0.0 0.1 0.2 0.4 0.5	120 120 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 0	100 100 100 100 0	
E10-E-PA	83.7 84.1	4.9 4.9	9.9 9.9			Propional dehyde	1.5 1.0	0.0 0.1	100 100	24	0	0	100	100
	83.3 84.1 84.4 81.3 80.3	4.9 4.9 5.0 4.8 4.7	9.8 9.9 9.9 9.6 9.5				2.0 1.0 0.5 4.0 5.0	0.0 0.1 0.2 0.4 0.5	120 120 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 0	100 100 100 100 0	

*1 100 → Perfectly phase-solved. 0 → Layer-separated

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Fig. 20

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*!
	HC Naphtha	Ether MBE	Alcohol	NPA	IPA	NBA	I BA			Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	
E20-E	70.0	10.0	20.0					None	0.0	100	120	8	100
	69.9	10.0	20.0					None	0.1	100	120	0	100
	70.0	10.0	20.0					None	0.0	120	24	100	100
	69.0	9.9	19.7					None	1.5	120	24	0	0
E20-E-Me	68.8	9.8	19.7					None	1.7	120	24	0	0
	69.7	10.0	19.9					Methanol	0.5	100	24	0	100
	69.7	10.0	19.9						0.5	120	24	0	100
	69.7	10.0	19.9						0.0	120	24	0	100
E20-E-EG	69.7	10.0	19.9					Ethyleneglycol	0.5	100	24	0	100
	69.7	10.0	19.9						0.5	120	24	0	100
	69.7	10.0	19.9						0.0	120	24	0	100
	69.7	10.0	19.9							100	24	0	100
E20-E-Ac	67.9	9.7	19.4					Acetone	3.0	100	24	0	100
	68.9	9.8	19.7						1.5	100	24	0	100
	67.2	9.6	19.2						0.1	100	24	0	100
	68.5	9.8	19.6						4.0	120	24	0	100
E20-E-GM	69.7	10.0	19.9						2.0	120	24	0	100
	65.5	9.4	18.7						0.3	120	24	0	100
	63.9	9.1	18.3						5.0	120	24	0	100
	65.8	9.4	18.8						7.0	120	24	0	100
E20-E-BA	67.8	9.7	19.4					Methylformate	6.0	100	24	0	100
	64.4	9.2	18.4						3.0	100	24	0	100
	67.1	9.6	19.2						8.0	120	24	0	100
	68.5	9.8	19.6						4.0	120	24	0	100
E20-E-BK	64.8	9.3	18.5						2.0	120	24	0	100
	63.2	9.0	18.1						6.0	120	24	0	100
	68.6	9.8	19.6						8.0	120	24	0	100
	69.2	9.9	19.8					Butylaldehyde	2.0	100	24	0	100
E20-E-BK	68.3	9.8	19.5						1.0	100	24	0	100
	69.2	9.9	19.8						2.5	120	24	0	100
	69.5	9.9	19.9						1.0	120	24	0	100
	66.9	9.6	19.1						0.5	120	24	0	100
E20-E-BK	66.0	9.4	18.9						3.0	120	24	0	100
	68.6	9.8	19.6						4.0	120	24	0	100
	69.2	9.9	19.8						1.7	120	24	0	100
	68.3	9.8	19.5							0.1	120	24	0

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 21

Designation of Formulation	Fuel Composition (wt%)						Additive	Water Loading/Fuel (wt%)	Evaluation Temp. (°C)	Weight Loss Rate (%)	Room Temp. 25° C	Low Temp. -10° C	Stability of Fuel *	
	HC Naphtha	Ether EtBE	Ethanol	NPA	IPA	NBA	I BA	Kind	Loading/Fuel (wt%)					
E50-E	20.0	30.0	50.0					None	0.0	100	120	0	100	
	20.0	30.0	49.9					None	0.1	100	120	0	100	
	20.0	30.0	50.0					None	0.0	120	24	100	100	
	17.5	26.3	43.8					None	12.5	120	24	0	0	
E50-E-Me	17.4	26.1	43.5					None	13.0	120	24	0	0	
	19.8	29.8	49.6					Methanol	0.8	0.0	100	24	0	
	19.8	29.7	49.5						1.0	0.0	120	24	0	
	19.8	29.8	49.7						Ethylene glycol	0.7	0.0	100	24	0
E50-E-EG	19.9	29.8	49.7							1.0	0.0	120	24	0
	19.8	29.7	49.5								100	24	0	100
	19.2	28.8	48.0								100	24	0	100
	19.6	29.4	49.0								100	24	0	100
E50-E-MEK	18.8	28.2	47.0					Methyl ethyl ketone	4.0	0.0	100	24	0	100
	19.6	29.4	49.0						2.0	0.1	100	24	0	100
	19.9	29.8	49.7							6.0	0.0	120	24	0
	16.5	24.8	41.3							2.0	0.1	120	24	0
E50-E-GE	16.0	24.0	40.0							0.4	0.2	120	24	0
	18.8	28.2	47.0							5.0	12.5	120	24	0
	19.4	29.1	48.5							7.0	13.0	120	24	0
	18.0	27.0	45.0									100	24	0
E50-E-AA	19.0	28.5	47.5					Ethyl formate	6.0	0.0	100	24	0	100
	19.6	29.3	48.9						3.0	0.1	100	24	0	100
	16.7	25.1	41.8							10.0	0.0	120	24	0
	16.2	24.3	40.5							5.0	0.1	120	24	0
	19.4	29.1	48.5							2.0	0.2	120	24	0
	19.7	29.5	49.2							4.0	0.0	120	24	0
	19.2	28.8	48.0							2.0	0.1	120	24	0
	19.6	29.4	49.0							1.0	0.2	120	24	0
	19.8	29.6	49.4							2.0	12.5	120	24	0
	17.1	25.7	42.8							3.0	13.0	120	24	0
	16.8	25.2	42.0									100	24	0
								Acetaldehyde	3.0	0.0	100	24	0	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 22

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Loading/Fuel (wt%)	Water (wt%)	Aluminum Corrosion Test			Stability of Fuel ^a
	HC Naphtha	Ether MTBE	Ethanol	NPA	IPA	NBA	I BA			Evaluation Temp. (°C)	Time (hr)	Weight Loss Rate (%)	
IN40-E	30.0	30.0	20.0	20.0	20.0	20.0	None	0.0	90	24	100	100	100
	30.0	30.0	19.9	19.9	20.0	20.0	None	0.1	90	24	0	100	100
	30.0	30.0	20.0	20.0	20.0	20.0	None	0.0	120	24	100	100	100
	28.4	28.4	18.9	18.9	18.9	18.9	None	5.5	120	24	0	100	0
IN40-E-Me	29.8	29.8	19.8	19.8	19.8	19.8	Methanol	0.8	0.0	100	24	0	100
	29.8	29.8	19.9	19.9	19.9	19.9		0.4	100	24	0	100	100
	29.5	29.5	19.7	19.7	19.7	19.7		1.7	0.0	120	24	0	100
	29.6	29.6	19.8	19.8	19.8	19.8		1.0	0.2	120	24	0	100
IN40-E-EG	29.1	29.1	19.4	19.4	19.4	19.4		3.0	0.0	120	24	0	100
	29.3	29.3	19.6	19.6	19.6	19.6		2.0	0.2	120	24	0	100
	29.6	29.6	19.7	19.7	19.7	19.7		1.0	0.4	120	24	0	100
	27.7	27.7	18.4	18.4	18.4	18.4		2.0	5.8	120	24	0	100
IN40-E-AC	29.6	29.6	19.7	19.7	19.8	19.8	Ethylene glycol	1.5	0.0	100	24	0	100
	29.6	29.6	19.8	19.8	19.8	19.8		1.0	0.2	100	24	0	100
	29.1	29.1	19.4	19.4	19.4	19.4		3.0	0.0	120	24	0	100
	29.3	29.3	19.6	19.6	19.6	19.6		2.0	0.2	120	24	0	100
IN40-E-GM	29.9	29.9	20.0	20.0	20.0	20.0	Acetone	0.2	0.0	100	24	0	100
	29.9	29.9	20.0	20.0	20.0	20.0		0.1	0.1	100	24	0	100
	29.9	29.9	20.0	20.0	20.0	20.0		0.2	0.0	120	24	0	100
	27.8	27.8	18.5	18.5	18.5	18.5		0.1	0.1	120	24	0	100
IN40-E-BA	29.6	29.6	19.7	19.7	19.8	19.8	Methyl formate	1.5	0.0	100	24	0	100
	29.7	29.7	19.8	19.8	19.8	19.8		0.8	0.1	100	24	0	100
	29.1	29.1	19.4	19.4	19.4	19.4		3.0	0.0	120	24	0	100
	29.6	29.6	19.8	19.8	19.8	19.8		1.0	0.2	120	24	0	100
IN40-E-BA	29.8	29.8	19.8	19.8	19.8	19.8		0.5	0.3	120	24	0	100
	27.8	27.8	18.5	18.5	18.5	18.5		2.0	5.5	120	24	0	100
	27.4	27.4	18.2	18.2	18.2	18.2		3.0	5.8	120	24	0	100
	27.4	27.4	18.2	18.2	18.2	18.2		3.0	5.8	120	24	0	100

*1 100 → Perfectly phase-solved, 0 → Layer-separated

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Fig. 23

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*
	HC Naphtha	Ether MTBE	Ethanol	NPA	IPA	NBA	I BA			Evaluation Temp. (°C)	Time (hr)	Evaluation Rate (%)	Weight Loss Rate (%)
IN15-E	80.0 79.9	5.0 5.0		10 10	5 5		None None	0.0 0.1	90 90	24 24	6 0	100 100	100 100
	80.0 79.5	5.0 5.0		10.0 9.9	5.0 5.0		None None None	0.0 0.6 0.8	120 120 120	24 24 24	100 0 0	100 0 0	100 0 0
	79.6 79.6	5.0 5.0		10.0 10.0	5.0 5.0		Methanol	0.5 0.3	100 100	24 24	0 0	100 100	100 100
	78.8 79.2	4.9 5.0		9.9 9.9	4.9 5.0			1.5 0.8 0.5 0.5 0.6	120 120 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 100	100 100 100 100 100
IN15-E-Me	79.4 79.4	5.0 5.0		9.9 9.9	5.0 5.0			1.0 0.8	120 120	24 24	0 0	100 100	100 100
	79.1 78.6	4.9 4.9		9.9 9.8	4.9 4.9			1.0 0.8	120 120	24 24	0 0	100 100	100 100
	78.4 79.0	4.9 4.9		9.8 9.9	4.9 4.9		Propylene glycol	2.0 1.0	100 100	24 24	0 0	100 100	100 100
	76.8 78.2	4.8 4.9		9.6 9.8	4.8 4.9			4.0 2.0 1.0	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
IN15-E-PG	78.9	4.9		9.9	4.9								
	76.8 78.2	4.8 4.9		9.6 9.8	4.8 4.9								
	76.6 78.6	4.9 4.9		9.9 9.8	4.9 4.9								
	75.4	4.7											
IN15-E-MBK	79.8 79.8	5.0 5.0		10.0 10.0	5.0 5.0		Methyl isobutyl ketone	0.3 0.2	100 100	24 24	0 0	100 100	100 100
	79.6 79.8	5.0 5.0		10.0 10.0	5.0 5.0			0.5 0.2	120 120	24 24	0 0	100 100	100 100
	79.1 78.6	4.9 4.9		9.9 9.8	4.9 4.9			0.5 1.0	120 120	24 24	0 0	100 100	100 100
	78.4 78.6	4.9 4.9		9.9 9.8	4.9 4.9								
IN15-E-GE	79.2 79.4	5.0 5.0		9.9 9.9	5.0 5.0		Ethyl formate	1.0 0.6	100 100	24 24	0 0	100 100	100 100
	76.0 78.2	4.8 4.9		9.5 9.8	4.8 4.9			5.0 2.0 1.0	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	78.9 76.3	4.9 4.8		9.9 9.5	4.9 4.8			4.0 5.0	120 120	24 24	0 0	100 100	100 100
	75.4	4.7		9.4	4.7								
IN15-E-PA	79.8 79.8	5.0 5.0		10.0 10.0	5.0 5.0		Propion aldehyde	0.2 0.1	100 100	24 24	0 0	100 100	100 100
	79.7 79.8	5.0 5.0		10.0 10.0	5.0 5.0			0.4 0.2 0.1	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	79.8	5.0		10.0	5.0			0.2 0.1	120 120	24 24	0 0	100 100	100 100

*1 100 → Perfectly phase-solved, 0 → Layer-separated

Fig. 24

Designation of Formulation	Fuel Composition (wt%)					Additive Kind	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test		Stability of Fuel*
	HC Naphtha	Ether DBE	Ethanol	NPA	I PA	I BA			Evaluation Temp. (°C)	Evaluation Time (hr)	
IN75-E	20.0	5.0		35	40		None	0.0	90	24	100
	20.0	5.0		35.0	39.9		None	0.1	90	24	100
	20.0	5.0		34.9	39.9		None	0.2	90	24	100
	20.0	5.0		35.0	40.0		None	0.0	120	24	100
	19.9	5.0		34.8	39.8		None	0.6	120	24	100
	19.8	5.0		34.7	39.7		None	0.8	120	24	100
IN75-E-Me	19.8	5.0		34.7	39.6		Methanol	1.0	100	24	0
	19.8	5.0		34.7	39.7		Methanol	0.5	100	24	0
	19.6	4.9		34.3	39.2			2.0	0.0	120	24
	19.7	4.9		34.5	39.5			1.0	0.3	120	24
	19.8	5.0		34.7	39.6			0.5	0.5	120	24
	19.2	4.8		33.6	38.4		Ethylene glycol	4.0	0.0	100	24
IN75-E-EG	19.5	4.9		34.2	39.0			2.0	0.4	100	24
	18.8	4.7		32.9	37.6			6.0	0.0	120	24
	19.3	4.8		33.8	38.7			3.0	0.3	120	24
	19.6	4.9		34.3	39.2			1.5	0.5	120	24
	20.0	5.0		34.9	39.9					120	24
	20.0	5.0		34.9	39.9					120	24
IN75-E-MPK	20.0	5.0		34.9	39.9		Methyl- <i>n</i> -propyl ketone	0.2	0.0	100	24
	20.0	5.0		34.9	39.9			0.1	100	24	0
	20.0	5.0		34.9	39.9			0.2	0.0	120	24
	20.0	5.0		34.9	39.9			0.1	0.1	120	24
	19.6	4.9		34.3	39.2		Ethyl formate	2.0	0.0	100	24
	19.8	4.9		34.6	39.6			1.0	0.1	100	24
IN75-E-GE	19.3	4.8		33.8	38.6			3.5	0.0	120	24
	19.7	4.9		34.4	39.3			1.5	0.2	120	24
	19.8	4.9		34.6	39.6			0.8	0.3	120	24
	19.3	4.8		33.8	38.6					120	24
	19.7	4.9		34.4	39.3					120	24
	19.8	4.9		34.6	39.6					120	24
IN75-E-AA	19.9	5.0		34.9	39.9		Acetaldehyde	0.3	0.0	100	24
	19.9	5.0		34.9	39.9			0.2	0.1	100	24
	19.9	5.0		34.8	39.8			0.6	0.0	120	24
	19.9	5.0		34.9	39.8			0.3	0.1	120	24
	19.9	5.0		34.9	39.8			0.2	0.2	120	24
	19.9	5.0		34.9	39.8					120	24

*1 100 →Perfectly phase-separated. 0 →Layer-separated

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Fig. 25

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Loading/Fuel (wt%)	Water	Aluminum Corrosion Test			Stability of Fuel*!
	HC Naphtha	Ether MBE	Alcohol Ethanol	NPA IPA	NBA	I BA				Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	
EIB40-E	30.0	30.0	20.0	20.0	20.0	20.0	None	0.0	90	24	100	100	100
	30.0	30.0	29.9	20.0	20.0	20.0	None	0.1	90	24	0	100	100
	30.0	30.0	20.0	20.0	18.6	18.6	None	0.0	120	24	100	100	100
	27.9	27.9	18.6	18.6	18.6	18.6	None	6.9	120	24	0	100	0
	27.8	27.8	18.6	18.6	18.6	18.6	None	7.2	120	24	0	0	0
EIB40-E-Me	29.6	29.6	19.7	19.7	19.7	19.7	Methanol	1.5	0.0	100	24	0	100
	29.6	29.6	19.7	19.7	19.7	19.7	Methanol	0.8	0.5	100	24	0	100
	29.4	29.4	19.6	19.6	19.6	19.6		2.0	0.0	120	24	0	100
	29.6	29.6	19.7	19.7	19.7	19.7		1.0	0.5	120	24	0	100
	29.6	29.6	19.7	19.7	19.7	19.7		0.5	1.0	120	24	0	100
EIB40-E-EG	29.7	29.7	19.8	19.8	19.8	19.8	Ethylene glycol	1.0	0.0	100	24	0	100
	29.7	29.7	19.8	19.8	19.8	19.8	Ethylene glycol	0.7	0.4	100	24	0	100
	29.4	29.4	19.6	19.6	19.6	19.6		2.0	0.0	120	24	0	100
	29.5	29.5	19.6	19.6	19.6	19.6		1.5	0.3	120	24	0	100
	29.6	29.6	19.7	19.7	19.7	19.7		1.0	0.5	120	24	0	100
EIB40-E-Ac	29.9	29.9	20.0	20.0	20.0	20.0	Acetone	0.2	0.0	100	24	0	100
	29.9	29.9	20.0	20.0	20.0	20.0	Acetone	0.1	0.1	100	24	0	100
	29.1	29.1	19.4	19.4	19.4	19.4		3.0	0.0	120	24	0	100
	29.6	29.6	19.8	19.8	19.8	19.8		1.0	0.2	120	24	0	100
	29.8	29.8	19.9	19.9	19.9	19.9		0.2	0.5	120	24	0	100
	27.0	27.0	18.0	18.0	18.0	18.0		3.0	6.9	120	24	0	100
	26.6	26.6	17.8	17.8	17.8	17.8		4.0	7.2	120	24	0	100
EIB40-E-GM	29.3	29.3	19.5	19.5	19.5	19.5	Methyl formate	2.5	0.0	100	24	0	100
	29.5	29.5	19.7	19.7	19.7	19.7	Methyl formate	1.5	0.2	100	24	0	100
	28.5	28.5	19.0	19.0	19.0	19.0		5.0	0.0	120	24	0	100
	29.3	29.3	19.6	19.6	19.6	19.6		2.0	0.2	120	24	0	100
	29.6	29.6	19.7	19.7	19.7	19.7		1.0	0.5	120	24	0	100
	27.3	27.3	18.2	18.2	18.2	18.2		2.0	6.9	120	24	0	100
	26.9	26.9	18.0	18.0	18.0	18.0		3.0	7.2	120	24	0	100
EIB40-E-BA	29.8	29.8	19.9	19.9	19.9	19.9	Butyl aldehyde	0.6	0.0	100	24	0	100
	29.8	29.8	19.9	19.9	19.9	19.9	Butyl aldehyde	0.1	0.5	100	24	0	100
	29.7	29.7	19.8	19.8	19.8	19.8		1.0	0.0	120	24	0	100
	29.8	29.8	19.9	19.9	19.9	19.9		0.2	0.5	120	24	0	100
	29.7	29.7	19.8	19.8	19.8	19.8		0.1	1.0	120	24	0	100
	27.6	27.6	18.4	18.4	18.4	18.4		1.0	6.9	120	24	0	100
	27.2	27.2	18.2	18.2	18.2	18.2		2.0	7.2	120	24	0	100

*1 100 →Perfectly phase-solved, 0 →Layer-separated

Fig. 26

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*		
	HG Naphtha	Ether EtBE	Ethanol	NPA	I PA	NBA	I BA		Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	Room Temp.	Low Temp. 25° C	
EIB15-E	80.0 79.9	5.0 5.0	5.0 5.0			10.0 10.0	None None		0.0 0.1	90° 90°	24 24	0 0	100 100	
	80.0 79.5	5.0 5.0	5.0 5.0			10.0 9.9	None None		0.0 0.6 0.8	120° 120° 120°	24 24 24	100 100 0	100 100 0	
	79.4 79.4	5.0 5.0	5.0 5.0			9.9 9.9	None None		0.0 0.3 0.5	100° 100° 100°	24 24 24	0 0 0	100 100 0	
	79.2 79.4	5.0 5.0	5.0 5.0			9.9 9.9	Methanol	1.0 0.5	0.0 0.3	24 24	0 0	100 100	100 100	
	78.8 79.0	4.9 4.9	4.9 4.9			9.9 9.9			1.5 0.8	0.0 0.4	24 24	0 0	100 100	
EIB15-E-Me	79.0 79.0	4.9 4.9	4.9 4.9			9.9 9.9			0.6 1.5	120° 120°	24 24	0 0	100 100	
	79.0 78.2	4.9 4.9	4.9 4.9			9.9 9.8			0.6 0.8	120° 120°	24 24	0 0	100 100	
	78.8 78.2	4.9 4.9	4.9 4.9			9.9 9.8			0.6 1.0	120° 120°	24 24	0 0	100 100	
	78.2 78.8	4.9 4.9	4.9 4.9			9.9 9.9			0.0 0.2	100° 100°	24 24	0 0	100 100	
EIB15-E-PG	78.8 79.2	4.9 5.0	4.9 5.0			9.9 9.9	Propylene glycol	1.5 0.8	0.0 0.2	100° 100°	24 24	0 0	100 100	
	77.6 78.2	4.9 4.9	4.9 4.9			9.7 9.8			3.0 2.0	0.0 0.3	120° 120°	24 24	0 0	100 100
	78.8	4.9	4.9			9.9			1.0	0.5	120° 120°	24 24	0 0	100 100
	79.2	5.0	5.0			9.9								0
EIB15-E-DEK	79.2 79.6	5.0 5.0	5.0 5.0			9.9 10.0	Diethyl ketone	1.0 0.4	0.0 0.1	100° 100°	24 24	0 0	100 100	
	78.8 79.4	4.9 5.0	4.9 5.0			9.9 9.9			1.5 0.7	0.0 0.1	120° 120°	24 24	0 0	100 100
	79.6 77.5	5.0 4.8	5.0 4.8			10.0 9.7			0.2 2.5	0.3 0.6	120° 120°	24 24	0 0	100 100
	76.6 77.5	4.8 4.8	4.8 4.8			9.6 9.7			3.5 2.6	0.8 0.8	120° 120°	24 24	0 0	100 100
	78.8 79.0	4.9 4.9	4.9 4.9			9.9 9.9	Methyl acetate	1.5 1.0	0.0 0.2	100° 100°	24 24	0 0	100 100	
	77.6 79.2	4.9 4.9	4.9 4.9			9.7 9.9			3.0 1.0	0.0 0.2	120° 120°	24 24	0 0	100 100
EIB15-E-GM	78.8 79.0	4.9 4.9	4.9 4.9			9.9 9.9			0.5 0.5	0.5 0.6	120° 120°	24 24	0 0	100 100
	77.2 78.2	4.9 4.9	4.9 4.9			9.9 9.8			1.7 1.7	0.6 0.8	120° 120°	24 24	0 0	100 100
	77.3 77.3	4.8 4.8	4.8 4.8			9.7 9.7			2.6 2.6	0.8 0.8	120° 120°	24 24	0 0	100 100
	79.5 79.7	5.0 5.0	5.0 5.0			9.9 10.0	Propional aldehyde	0.6 0.1	0.0 0.3	100° 100°	24 24	0 0	100 100	
EIB15-E-PA	79.5 79.2	5.0 5.0	5.0 5.0			9.9 9.9			1.0 0.4	0.0 0.2	120° 120°	24 24	0 0	100 100
	79.5 79.5	5.0 5.0	5.0 5.0			9.9 9.9			0.2 0.4	0.2 0.4	120° 120°	24 24	0 0	100 100
	79.5 79.5	5.0 5.0	5.0 5.0			9.9 9.9								0

*1 100—Perfectly phase-solved, 0—Layer-separated

Fig. 27

Designation of Formulation	Fuel Composition (wt%)						Kind	Additive	Water	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ether DBE	Ethanol	NPA	I PA	NBA	I BA			Loading/Fuel (wt%)	Loading/Fuel (wt%)	Evaluation Temp. (°C)	Weight Loss Rate (%)	
EIB75	20.0	5.0	35.0			40.0	None		0.0	90	90	24	100	100
	20.0	5.0	35.0			39.9	None		0.1	90	24	100	100	100
	20.0	5.0	34.9			39.9	None		0.2	90	24	0	100	100
	20.0	5.0	35.0			40.0	None		0.0	120	24	100	100	100
	19.8	5.0	34.7			39.6	None		1.0	120	24	100	100	100
	19.8	4.9	34.6			39.5	None		1.2	120	24	0	100	100
EIB75-Me	19.7	4.9	34.5			39.4	Methanol		1.5	0.0	100	24	0	100
	19.7	4.9	34.5			39.4			1.0	0.5	100	24	0	100
	19.6	4.9	34.3			39.2			2.0	0.0	120	24	0	100
	19.6	4.9	34.3			39.2			1.5	0.5	120	24	0	100
	19.6	4.9	34.3			39.2			1.0	1.0	120	24	0	100
	19.6	4.9	34.3											
EIB75-E-EG	19.6	4.9	34.3			39.2	Ethylene glycol		2.0	0.0	100	24	0	100
	19.7	4.9	34.5			39.4			1.0	0.5	100	24	0	100
	20.0	5.0	35.0			40.0								
	19.2	4.8	33.6			38.4			4.0	0.0	120	24	0	100
	19.3	4.8	33.8			38.6			3.0	0.5	120	24	0	100
	19.4	4.9	34.0			38.8			2.0	1.0	120	24	0	100
EIB75-MEK	19.4	4.9	34.0			38.8	Methyl ethyl ketone		3.0	0.0	100	24	0	100
	19.9	5.0	34.8			39.8			0.3	0.3	100	24	0	100
	19.0	4.8	33.3			38.0			5.0	0.0	120	24	0	100
	19.6	4.9	34.2			39.1			2.0	0.2	120	24	0	100
	19.8	4.9	34.6			39.5			0.2	1.0	120	24	0	100
EIB75-E-GM	19.2	4.8	33.6			38.4	Methyl formate		4.0	0.0	100	24	0	100
	19.5	4.9	34.2			39.1			2.0	0.3	100	24	0	100
	18.4	4.6	32.2			36.8			8.0	0.0	120	24	0	100
	19.1	4.8	33.5			38.3			4.0	0.3	120	24	0	100
	19.4	4.9	34.0			38.8			2.0	1.0	120	24	0	100
EIB75-AA	19.8	5.0	34.7			39.7	Acetaldehyde		0.8	0.0	100	24	0	100
	19.9	5.0	34.8			39.8			0.2	0.3	100	24	0	100
	19.8	5.0	34.7			39.6			1.0	0.0	120	24	0	100
	19.9	5.0	34.8			39.7			0.4	0.3	120	24	0	100
	19.9	5.0	34.8			39.7			0.2	0.5	120	24	0	100

*1 100 →Perfectly phase-solved. 0 →Layer-separated

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Fig. 28

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Water Loading/Fuel (wt%)	Fuel Evaluation Temp. (°C)	Aluminum Corrosion Test Time (hr)	Weight Loss Rate (%)	Stability of Fuel* Room Temp. Low Temp. 25° C -10° C	
	HC Naphtha	Ether MTBE	Ethanol	NPA	IPA	NBA							
PNB30-F	40.0 39.9	30.0 30.0		10.0 10.0	10.0 10.0	10.0 10.0	None None	0.0 0.1	80 80	120 120	15 0	100 100 100 100	
	40.0 38.9	30.0 29.2		10.0 9.7	10.0 9.7	9.7 9.7	None None	0.0 2.7	120 120	24 24	100 0	100 0 100 0	
PNB30-E-Me	39.6 39.7	29.7 29.8		9.9 9.9	9.9 9.9	9.9 9.9	Methanol	1.0 0.4	0.0 0.3	100 100	24 24	0 0	100 100 100 100
	39.4 39.5	29.6 29.6		9.9 9.9	9.9 9.9	9.9 9.9		1.5 1.0	0.0 0.2	120 120	24 24	0 0	100 100 100 100
PNB30-E-G	39.2 39.5	29.4 29.6		9.8 9.9	9.8 9.9	9.8 9.9	Ethylene glycol	2.0 1.0	0.0 0.2	100 100	24 24	0 0	100 100 100 100
	39.0 39.3	29.3 29.5		9.8 9.8	9.8 9.8	9.8 9.9		2.5 1.5	0.0 0.2	120 120	24 24	0 0	100 100 100 100
PNB30-E-Ac	39.9 39.9	29.9 29.9		10.0 10.0	10.0 10.0	10.0 10.0	Acetone	0.2 0.1	0.0 0.1	100 100	24 24	0 0	100 100 100 100
	39.9 39.9	29.9 29.9		10.0 10.0	10.0 10.0	10.0 10.0		0.2 0.1	0.0 0.1	120 120	24 24	0 0	100 100 100 100
PNB30-E-GM	38.1 37.6	28.6 28.2		9.5 9.4	9.5 9.4	9.5 9.4		2.0 3.0	2.7 3.0	120 120	24 24	0 0	100 100 100 0
	39.4 39.5	29.6 29.6		9.9 9.9	9.9 9.9	9.9 9.9	Methyl formate	1.5 1.0	0.0 0.2	100 100	24 24	0 0	100 100 100 100
PNB30-E-BA	39.8 39.8	29.9 29.9		10.0 10.0	10.0 10.0	10.0 10.0	Butyl aldehyde	0.4 0.1	0.0 0.2	100 100	24 24	0 0	100 100 100 100
	39.9 39.8	29.9 29.9		10.0 10.0	10.0 10.0	10.0 10.0		0.5 0.2	0.0 0.3	120 120	24 24	0 0	100 100 100 100

*1 100 —Perfectly phase-separated. 0 —Layer-separated

Fig. 29

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*
	HC Naphtha	Ether	NPA	I PA	NBA	I BA				Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	
PNB15-E-F	80.0	5.0		5.0	5.0	5.0	None	0.0	0.0	80	120	3	100
	79.9	5.0		5.0	5.0	5.0	None	0.1	0.1	80	120	0	100
	80.0	5.0		5.0	5.0	5.0	None	0.0	0.0	120	24	100	100
PNB15-E-Me	79.6	5.0		5.0	5.0	5.0	None	0.5	0.5	120	24	0	100
	79.4	5.0		5.0	5.0	5.0	None	0.7	0.7	120	24	0	0
	79.4	5.0		5.0	5.0	5.0	Methanol	0.8	0.0	100	24	0	100
PNB15-E-Me	79.5	5.0		5.0	5.0	5.0	Methanol	0.4	0.2	100	24	0	100
	78.8	4.9		4.9	4.9	4.9		1.5	0.0	120	24	0	100
	79.0	4.9		4.9	4.9	4.9		1.0	0.2	120	24	0	100
PNB15-E-PG	79.4	5.0		5.0	5.0	5.0		0.5	0.3	120	24	0	100
	78.0	4.9		4.9	4.9	4.9		2.0	0.5	120	24	0	100
	77.0	4.8		4.8	4.8	4.8		3.0	0.7	120	24	0	100
PNB15-E-PG	77.6	4.9		4.9	4.9	4.9	Propylene glycol	3.0	0.0	100	24	0	100
	78.6	4.9		4.9	4.9	4.9		1.5	0.2	100	24	0	100
	76.8	4.8		4.8	4.8	4.8		4.0	0.0	120	24	0	100
PNB15-E-MPK	78.2	4.9		4.9	4.9	4.9		2.0	0.2	120	24	0	100
	79.0	4.9		4.9	4.9	4.9		1.0	0.3	120	24	0	100
	79.8	5.0		5.0	5.0	5.0	Methyl- τ -propyl ketone	0.3	0.0	100	24	0	100
PNB15-E-MPK	79.8	5.0		5.0	5.0	5.0		0.2	0.1	100	24	0	100
	79.6	5.0		5.0	5.0	5.0		0.5	0.0	120	24	0	100
	79.7	5.0		5.0	5.0	5.0		0.2	0.2	120	24	0	100
PNB15-E-SM	76.4	4.8		4.8	4.8	4.8		4.0	0.5	120	24	0	100
	75.4	4.7		4.7	4.7	4.7		5.0	0.7	120	24	0	100
	78.8	4.9		4.9	4.9	4.9	Methyl acetate	1.5	0.0	100	24	0	100
PNB15-E-SM	79.0	4.9		4.9	4.9	4.9		1.0	0.2	100	24	0	100
	75.2	4.7		4.7	4.7	4.7		6.0	0.0	120	24	0	100
	77.4	4.8		4.8	4.8	4.8		3.0	0.2	120	24	0	100
PNB15-E-AA	79.0	4.9		4.9	4.9	4.9		1.0	0.3	120	24	0	100
	74.8	4.7		4.7	4.7	4.7		6.0	0.5	120	24	0	100
	73.8	4.6		4.6	4.6	4.6		7.0	0.7	120	24	0	0
PNB15-E-AA	79.8	5.0		5.0	5.0	5.0	Acetaldehyde	0.3	0.0	100	24	0	100
	79.8	5.0		5.0	5.0	5.0		0.2	0.1	100	24	0	100
	79.6	5.0		5.0	5.0	5.0		0.5	0.0	120	24	0	100

*| 100 —Perfectly phase-solved, 0 —Layer-separated

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Fig. 30

Designation of Formulation	Fuel Composition (wt%)						Additive Kind	Loading/Fuel (wt%)	Water	Aluminum Corrosion Test			Stability of Fuel*				
	HC Naphtha	Ether	Ethanol	IPA	NPA	IBA				Evaluation Temp. (°C)							
										25° C	80	120					
PNB75-E	20.0	5.0	25.0	25.0	25.0	None	Methanol	0.0	0.0	120	100	100	100				
	20.0	5.0	24.9	25.0	25.0	None		0.1	80	120	92	100	100				
	20.0	5.0	24.9	24.9	25.0	None		0.2	80	120	0	100	100				
	20.0	5.0	25.0	25.0	25.0	None		0.0	120	24	100	100	100				
	17.7	4.4	22.1	22.1	22.1	None		11.7	120	24	0	100	0				
	17.6	4.4	22.0	22.0	22.0	None		12.1	120	24	0	0	0				
PNB75-E-Me	19.8	5.0	24.8	24.8	24.8	Methanol	Ethylene glycol	1.0	0.0	100	24	0	100				
	19.9	5.0	24.8	24.8	24.8	0.4		0.3	100	24	0	100	100				
	19.6	4.9	24.5	24.5	24.5	2.0		0.0	120	24	0	100	100				
	19.7	4.9	24.6	24.6	24.6	1.5		0.2	120	24	0	100	100				
	19.8	4.9	24.7	24.7	24.7	0.8		0.4	120	24	0	100	100				
	17.3	4.3	21.6	21.6	21.6	2.0		11.7	120	24	0	100	100				
PNB75-E-EG	17.0	4.2	21.2	21.2	21.2	3.0	Propion aldehyde	12.1	120	24	0	100	0				
	19.2	4.8	24.0	24.0	24.0	4.0		0.0	100	24	0	100	100				
	19.6	4.9	24.6	24.6	24.6	1.5		0.3	100	24	0	100	100				
	19.0	4.8	23.8	23.8	23.8	5.0		0.0	120	24	0	100	100				
	19.3	4.8	24.2	24.2	24.2	3.0		0.3	120	24	0	100	100				
	19.6	4.9	24.5	24.5	24.5	1.5		0.5	120	24	0	100	100				
PNB75-E-MEK	19.9	5.0	24.9	24.9	24.9	Methyl ethyl ketone	Ethyformate	0.3	0.0	100	24	0	100				
	19.9	5.0	24.9	24.9	24.9	0.1		0.2	100	24	0	100	100				
	19.9	5.0	24.9	24.9	24.9	0.5		0.0	120	24	0	100	100				
	19.9	5.0	24.9	24.9	24.9	0.2		0.2	120	24	0	100	100				
	17.1	4.3	21.3	21.3	21.3	3.0		11.7	120	24	0	100	100				
	16.8	4.2	21.0	21.0	21.0	4.0		12.1	120	24	0	100	0				
PNB75-E-GE	19.2	4.8	24.0	24.0	24.0	Ethyformate	Propion aldehyde	4.0	0.0	100	24	0	100				
	19.6	4.9	24.5	24.5	24.5	2.0		0.2	100	24	0	100	100				
	18.8	4.7	23.5	23.5	23.5	6.0		0.0	120	24	0	100	100				
	19.4	4.8	24.2	24.2	24.2	3.0		0.2	120	24	0	100	100				
	19.7	4.9	24.7	24.7	24.7	1.0		0.4	120	24	0	100	100				
	16.9	4.2	21.1	21.1	21.1	4.0		11.7	120	24	0	100	100				
PNB75-E-PA	16.6	4.1	20.7	20.7	20.7	5.0	Propion aldehyde	12.1	120	24	0	100	0				
	19.9	5.0	24.9	24.9	24.9	0.3		0.0	100	24	0	100	100				
	19.9	5.0	24.9	24.9	24.9	0.1		0.2	100	24	0	100	100				
	19.9	5.0	24.9	24.9	24.9	0.5		0.0	120	24	0	100	100				

*1 100 →Perfectly phase-separated. 0 →Layer-separated

Fig. 31

Designation of Formulation	Fuel Composition (wt%)					Kind	Additive Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*
	HC Naphtha	Ether MTBE	Alcohol Ethanol	NPA	NBA				Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	
EIPP30-E	40.0	30.0	10.0	10.0	10.0	10.0	None	0.0	80	120	64	100
	39.9	30.0	10.0	10.0	10.0	10.0	None	0.1	80	120	0	100
	40.0	30.0	10.0	10.0	10.0	10.0	None	0.0	120	24	100	100
	38.4	28.8	9.6	9.6	9.6	9.6	None	3.9	120	24	0	0
EIPP30-E-Me	38.3	28.7	9.6	9.6	9.6	9.6	None	4.2	120	24	0	0
	39.4	29.6	9.9	9.9	9.9	9.9	Methanol	1.5	100	24	0	100
	39.6	29.7	9.9	9.9	9.9	9.9	Methanol	0.5	100	24	0	100
	39.0	29.3	9.8	9.8	9.8	9.8	Methanol	2.5	120	24	0	100
EIPP30-E-EG	39.2	29.4	9.8	9.8	9.8	9.8	Ethylene glycol	2.0	100	24	0	100
	39.4	29.6	9.9	9.9	9.9	9.9	Ethylene glycol	1.0	100	24	0	100
	38.0	28.5	9.5	9.5	9.5	9.5	Ethylene glycol	5.0	120	24	0	100
	38.6	28.9	9.6	9.6	9.6	9.6	Ethylene glycol	3.0	120	24	0	100
EIPP30-E-Ac	38.8	29.1	9.7	9.7	9.7	9.7	Ethylene glycol	2.0	120	24	0	100
	39.8	29.9	10.0	10.0	10.0	10.0	Acetone	3.0	100	24	0	100
	38.4	28.8	9.6	9.6	9.6	9.6	Acetone	0.2	100	24	0	100
	39.5	29.6	9.9	9.9	9.9	9.9	Acetone	4.0	120	24	0	100
EIPP30-E-GM	36.0	27.0	9.0	9.0	9.0	9.0	Acetone	1.0	120	24	0	100
	35.5	26.6	8.9	8.9	8.9	8.9	Acetone	0.2	120	24	0	100
	39.4	29.6	9.9	9.9	9.9	9.9	Methyl formate	1.5	100	24	0	100
	39.5	29.6	9.9	9.9	9.9	9.9	Methyl formate	1.0	100	24	0	100
EIPP30-E-BA	37.6	28.2	9.4	9.4	9.4	9.4	Methyl formate	6.0	120	24	0	100
	39.4	29.6	9.9	9.9	9.9	9.9	Methyl formate	1.0	120	24	0	100
	39.5	29.6	9.9	9.9	9.9	9.9	Methyl formate	0.2	120	24	0	100
	35.6	26.7	8.9	8.9	8.9	8.9	Methyl formate	7.0	120	24	0	100
EIPP30-E-BA	35.1	26.3	8.8	8.8	8.8	8.8	Methyl formate	8.0	120	24	0	100
	39.8	29.8	9.9	9.9	9.9	9.9	Butyl aldehyde	0.6	100	24	0	100
	39.8	29.9	10.0	10.0	10.0	10.0	Butyl aldehyde	0.2	100	24	0	100
	39.6	29.7	9.9	9.9	9.9	9.9	Butyl aldehyde	1.0	120	24	0	100
EIPP30-E-BA	39.7	29.8	9.9	9.9	9.9	9.9	Butyl aldehyde	0.2	120	24	0	100

*1 100 → Perfectly phase-solved. 0 → layer-separated

Fig. 32

Designation of Formulation	Fuel Composition (wt%)						Kind	Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Aluminum Corrosion Test			Stability of Fuel*	
	HC Naphtha	Ether DEE	Alcohol Ethanol	NPA	IPA	NBA				Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)		
EIPPI5-E	80.0 79.9	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	None None	0.0 0.1	80 80	120 120	9 0	100 100	100 100	
	80.0 79.4	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	None None None	0.0 0.8 1.0	120 120 120	24 24 24	100 0 0	100 0 0	100 0 0	
	79.4 79.2	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0								
EIPPI5-E-Me	79.2 79.3	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	Methanol	1.0 0.5	0.0 0.4	100 100	24 24	0 0	100 100	100 100
	78.4 78.9	4.9 4.9	4.9 4.9	4.9 4.9	4.9 4.9	4.9 4.9		2.0 1.0 0.5	0.0 0.4 0.6	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	79.1	4.9	4.9	4.9	4.9	4.9								
EIPPI5-E- PG	78.0 78.6	4.9 4.9	4.9 4.9	4.9 4.9	4.9 4.9	4.9 4.9	Propylene Glycol	2.5 1.5	0.0 0.3	100 100	24 24	0 0	100 100	100 100
	76.8 78.1 78.4	4.8 4.9 4.9	4.8 4.9 4.9	4.8 4.9 4.9	4.8 4.9 4.9	4.8 4.9 4.9		4.0 2.0 1.5	0.0 0.4 0.5	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	79.6	5.0	5.0	5.0	5.0	5.0								
EIPPI5-E-DEK	78.4 79.6	4.9 5.0	4.9 5.0	4.9 5.0	4.9 5.0	4.9 5.0	Diethyl ketone	2.0 0.2	0.0 0.3	100 100	24 24	0 0	100 100	100 100
	77.6 79.2	4.9 5.0	4.9 5.0	4.9 5.0	4.9 5.0	4.9 5.0		3.0 0.8 0.2	0.0 0.2 0.5	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	76.2 75.2	4.8 4.7	4.8 4.7	4.8 4.7	4.8 4.7	4.8 4.7		4.0 5.0	0.8 1.0	120 120	24 24	0 0	100 100	100 0
EIPPI5-E-SM	79.0 79.2	4.9 5.0	4.9 5.0	4.9 5.0	4.9 5.0	4.9 5.0	Methyl acetate	1.2 0.8	0.0 0.2	100 100	24 24	0 0	100 100	100 100
	77.2 78.2 78.8	4.8 4.9 4.9	4.8 4.9 4.9	4.8 4.9 4.9	4.8 4.9 4.9	4.8 4.9 4.9		3.5 2.0 1.0	0.0 0.2 0.5	120 120 120	24 24 24	0 0 0	100 100 100	100 100 100
	75.4 74.4	4.7 4.7	4.7 4.7	4.7 4.7	4.7 4.7	4.7 4.7		5.0 6.0	0.8 1.0	120 120	24 24	0 0	100 100	100 0
EIPPI5-E-PA	79.6 79.6	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	Propion aldehyde	0.5 0.2	0.0 0.3	100 100	24 24	0 0	100 100	100 100
	79.4 79.5	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0	5.0 5.0		0.8 0.2	0.0 0.4	120 120	24 24	0 0	100 100	100 100
	79.5	5.0	5.0	5.0	5.0	5.0								

*1 100 →Perfectly phase-solved. 0 →Layer-separated

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Fig. 33

Designation of Formulation	Fuel Composition (wt%)						Kind	Additive Loading/Fuel (wt%)	Water Loading/Fuel (wt%)	Evaluation Time (hr)	Aluminum Corrosion Test Rate (%)	Stability of Fuel*
	HC Naphtha	Ether ETBE	Ethanol	NPA	Acetol	NBA						
EIPP75-E	20.0 20.0 20.0	5.0 5.0 5.0	25.0 24.9 24.9	25.0 25.0 24.9	25.0 25.0 24.9	25.0 25.0 25.0	None None None	0.0 0.1 0.2	80 80 80	120 120 120	100 100 0	100 100 100
EIPP75-E-Me	19.6 19.7 19.7	4.9 4.9 4.9	24.5 24.6 24.6	24.5 24.6 24.6	24.5 24.6 24.6	24.3 24.4 24.6	None None None	0.0 1.5 1.7	120 120 120	24 24 24	100 100 0	100 100 100
EIPP75-E-EG	19.2 19.5 18.0 18.7 19.2	4.8 4.9 4.5 4.7 4.8	24.0 24.4 22.5 23.4 24.0	24.0 24.4 22.5 23.4 24.0	24.0 24.4 22.5 23.4 24.0	24.0 24.4 23.4 23.4 24.0	Methanol	2.0 1.0 3.0 2.0 0.6	100 100 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 100
EIPP75-E-MEK	19.4 19.9 19.0 19.8	4.9 5.0 4.8 4.9	24.3 24.9 23.8 24.7	24.3 24.9 23.8 24.7	24.3 24.9 23.8 24.7	24.3 24.9 23.8 24.7	Ethyleneglycol	4.0 2.0 10.0 6.0 3.0	100 100 120 120 120	24 24 24 24 24	0 0 0 0 0	100 100 100 100 100
EIPP75-E-GM	19.4 19.5 18.0 19.1 19.4	4.9 4.9 4.5 4.8 4.9	24.3 24.4 22.5 23.9 24.3	24.3 24.4 22.5 23.9 24.3	24.3 24.4 22.5 23.9 24.3	24.3 24.4 22.5 23.9 24.3	Methyl ethyl ketone	3.0 0.2 5.0 1.0 2.0	100 100 120 120 100	24 24 24 24 24	0 0 0 0 0	100 100 100 100 100
EIPP75-E-AA	19.9 19.9 19.8 19.9	5.0 5.0 5.0 5.0	24.9 24.9 24.8 24.8	24.9 24.9 24.8 24.8	24.9 24.9 24.8 24.8	24.9 24.9 24.8 24.8	Acetaldehyde	0.5 0.2 1.0 0.2	100 100 120 120	24 24 24 24	0 0 0 0	100 100 100 100

*1 100 → Perfectly phase-solved, 0 → layer-separated

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Fig. 34

Designation of Formulation	Fuel Composition (wt%)			Additive		Water Loading/Fuel (wt%)	Evaluation Temp. (°C)	Aluminum Corrosion Test		Stability of Fuel*1
	HC Naphtha	Alcohol Ethanol	NPAI PA	Kind	Loading/Fuel (wt%)			Evaluation Temp. (°C)	Weight Loss Rate (%)	
E2	98.0	2.0		None	0.0	120	120	1	100	100
	97.9	2.0		None	0.1	120	120	0	100	100
	97.8	2.0		None	0.2	120	120	0	100	0
	97.6	2.0		None	0.4	120	120	0	0	0
E2-Me	97.5	2.0		Methanol	0.5	0.0	120	120	0	100
E2-EG	97.5	2.0		Ethylene glycol	0.5	0.0	120	120	0	100
E2-Ac	96.0	2.0		Acetone	2.0	0.0	120	120	0	100
	96.9	2.0			1.0	0.1	120	120	0	100
	95.8	2.0			2.0	0.2	120	120	0	100
	94.7	1.9			3.0	0.4	120	120	0	0
E2-GE	96.0	2.0		Ethyl formate	2.0	0.0	120	120	0	100
	96.4	2.0			1.5	0.1	120	120	0	100
	93.9	1.9			4.0	0.2	120	120	0	100
	92.7	1.9			5.0	0.4	120	120	0	0
E2-BA	96.5	2.0		Butyl aldehyde	1.5	0.0	120	120	0	100
	96.9	2.0			1.0	0.1	120	120	0	100
	94.9	1.9			3.0	0.2	120	120	0	100
	93.7	1.9			4.0	0.4	120	120	0	0

*1 100 →Perfectly phase-solved, 0 →Layer-separated

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Fig. 35

< Ether Nonloaded Type >

Designation of Formulation	Aluminum Corrosion Inhibitor															
	Water		Methanol			Glycols			Ketones			Esters			Aldehydes	
	Added	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability
E2	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E10	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E20	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E50	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
IN40	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN15	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN75	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
EIB40	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	○
EIB15	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIB75	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
PNB30	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB15	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB75	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIPP30	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP15	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP75	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-

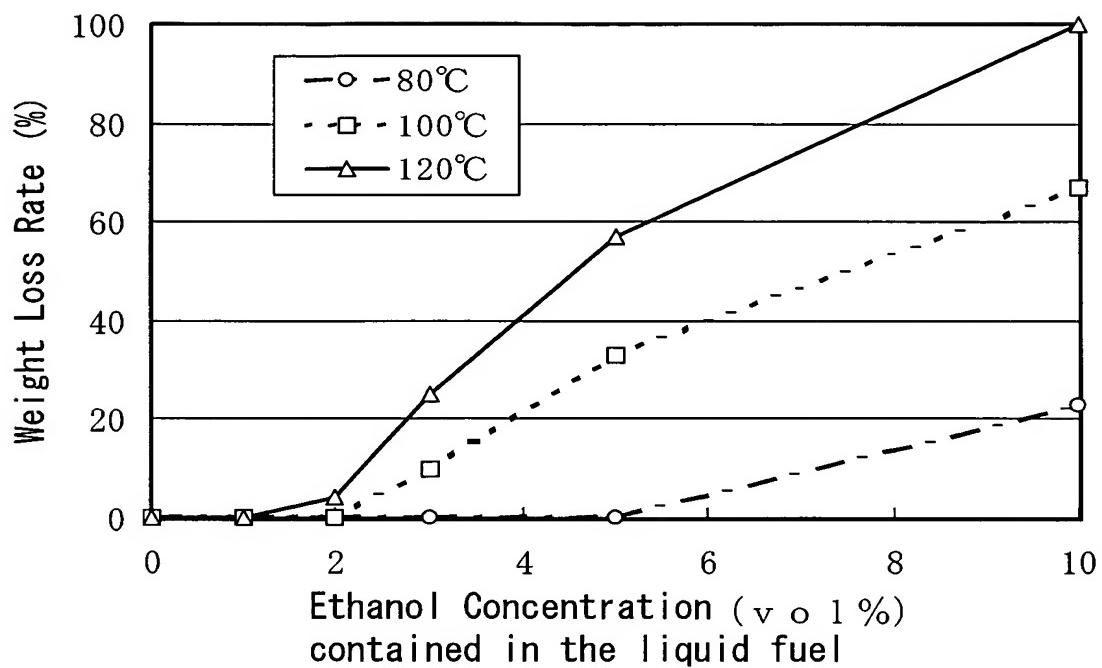
< Ether loaded Type >

Designation of Formulation	Aluminum Corrosion Inhibitor															
	Water		Methanol			Glycols			Ketones			Esters			Aldehydes	
	Added	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability	Added	Reduced	Low Temp. Stability
E10-E	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E20-E	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
E50-E	○	○	-	-	○	-	-	○	○	○	○	○	○	○	○	○
IN40-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN15-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
IN75-E	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
EIB40-E	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	○
EIB15-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIB75-E	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-
PNB30-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB15-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
PNB75-E	○	○	○	○	○	○	-	○	○	○	○	○	○	○	○	-
EIPP30-	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP15-	○	○	○	-	○	○	-	○	○	○	○	○	○	○	○	-
EIPP75-	○	○	○	-	○	○	-	○	○	-	○	○	-	○	○	-

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Fig. 36



Treatment Time 240 Hr

Ethanol Concentration(vol. 1%)		0	1	2	3	5	10
Weight Loss Rate (%)	80°C	0	0	0	0	0	23
	100°C	0	0	0	10	33	67
	120°C	0	0	4	25	57	100

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Fig. 37

Designation of Formulation	Fuel Composition (wt%)					Water Loading/Fuel (wt%)	Evaluation Temp. (°C)	Evaluation Time (hr)	Weight Loss Rate (%)	
	HC Naphtha	Ethanol	NPA	Alcohol	TBA					
I PB75	25.0			35.0		40.0	0.00	100	24	100
	25.0			35.0		39.9	0.10	100	24	58
	25.0			34.9		39.9	0.15	100	24	0
	25.0			35.0		40.0	0.00	120	24	100
	25.0			34.9		39.9	0.15	120	24	100
	24.9			34.9		39.9	0.30	120	24	0